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THE TELEPHONE CONVENTION.

What is regarded as probably the largest telephone convention ever brought together in this country, has been held with success in Buffalo this week by the Independent Telephone Association of America. The meeting was marked not only by large numbers, but by enthusiasm and a general spirit of hopefulness. The manufacturers, represented in force, all reported a large and growing demand for their product, and the managers of the independent exchanges were, with few exceptions, very cheerful as to the future. In some places, the competition has been too long and too strong to admit of any profits, and in other places, the renewal of cheap work by construction of more durability is proving expensive. But, on the whole, the independents may claim both to have justified their existence and to be doing excellent work.

The proceedings of the association still smack overmuch of "politics," and are wanting in technical interest. This is a condition that must be cured if the convention is to be of any benefit annually to the members. Judge Thomas made an excellent legal review of the whole situation from the beginning, but that cannot be done again each year, nor can the Association live on old wrongs now redressed. To-day the cry of "fraud," or that of "monopoly," has no meaning in the telephone art, and to depend upon their utility with the public will be a "waving of the bloody shirt" from which only the deluded wavers will suffer. The contest now is on the broad ground of merit and low rates, and here the independents are increasingly able to hold their own. They would, therefore, do well to let their technical men come more to the front for the open discussion of the endless questions of exchange management and operation. The National Electric Light Association has always been most influential when it has turned its attention to the serious matters of technical improvement rather than to those dealing with patents and politics. We print in full that part of President Thomas's address which gives a resumé of the various epochal stages to date of the telephone patent situation so far as it has affected the independent movement. This presentation we commend to readers who have not followed all of the steps, for nowhere have we seen the story told so connectedly and with such evident knowledge of every detail. While the narration deals with a matter which now, happily, possesses only a historical interest, yet it will always remain a famous chapter in patent annals.

A TECHNOLEXICON.

The Verein Deutscher Ingenieure, or union of German engineers, in Berlin, has recently issued circulars directed into the technological channels calling attention to the fact that there is a desire to secure a reliable technical dictionary comprehending all technical departments, but especially those of the technical sciences and those in which patents are granted. This dictionary it is proposed to prepare in three languages—namely, German, English and French—so that the dictionary shall be essentially a rendering into each of these languages of the meanings of terms employed in that and in the other two languages. In order to carry on the work voluntary contributions to the manuscript are invited from those who are interested in the preparation of such a dictionary.

We think that while it would be very desirable to possess such an international dictionary, and for which the name chosen seems ex-

cellently fitted, yet the amount of labor involved in its preparation, and the size of such a dictionary, if in any way complete, staggers the computer. Thus in the English literature of electrical engineering alone, there are at least 20,000 technical terms. Then there are mechanical engineering, chemical engineering and civil engineering to provide for, as well as a number of lesser arts, such as photography. Altogether, if the work were to be carried out thoroughly, we should expect to find at least 100,000 technical words or terms, which it is proposed not only to define in their own language, but also to render into two other languages. This would be a stupendous piece of work, and we can only suppose that the intention is to abbreviate it, and only to print lists of the more important and frequently used terms in technical use in these languages.

For our own part, we think it is quite unnecessary to translate the technical terms of one language into another language. The men who are interested in such a book are, naturally, technologists. As a class, technologists possess sufficient acquaintance with other languages to be content with a dictionary which shall define a technical term in the language to which it belongs, and without any translation into his own language. In other words, what is usually wanted by a technological reader or inquirer is the definition of a term and not its translation. If he reads a book in a foreign language, he must understand sufficient of that language to be satisfied with a definition in the simpler terms of that language. Consequently, we think that it is amply sufficient for all practical purposes if we can obtain a good technological dictionary of English terms in English, a similar one of French terms in French, and a third of German terms in German.

A ROTARY FIELD ELECTROSTATIC INDUCTION-MOTOR.

The new form of electrostatic induction motor of Professor Ho, described this week, is an interesting contribution to electrostatic apparatus from Japan. In view of the steadily rising electric potentials on long-distance transmission lines, it is impossible to say that electrostatic apparatus is devoid of utilitarian interest, while the theory of rotation is very interesting.

There are two standpoints from which a rotary magnetic field hysteresis motor may be regarded, both, of course, leading ultimately to the same result. One is to consider that when a rotating magnetic field sweeps around a simple, unwound, iron cylinder armature, the magnetic hysteresis of that armature causes its induced magnetic poles to lag behind the rotating field poles by a certain angle, and thus develops a tangential pull or torque. The other is to consider the amount of energy which would be liberated in the iron hysteretically by the successive magnetic reversals created under the influence of the rotating magnetic field, and to consider that, according to the theory of least action, the armature will rotate and develop torque, provided that the mechanical energy of rotation is less than the hysteretic energy at quiescence.

It does not seem clear that the torque and motion of the paper cylinder of Professor Arno's electrostatic motor is mainly due to electrostatic hysteresis, although, of course, hysteresis must aid the motion. If hysteresis were the sole moving force, then a solid dielectric cylinder should develop a greater torque than a hollow cylinder of the same material, swinging in air. Any cause which will allow the induced electric charges to lag behind the revolving electrostatic field would produce motion, and it seems possible that a leakage creeping of the induced charges around the paper cylinder might be mainly accountable for the effect. But in regard to Professor Ho's motor, the retardation of charges due to high resistance paths, is clearly the cause of rotation and bears a curious analogy to the very different condition of affairs in the polyphase rotary-field induction motor.

THE PERFORMANCE OF THE ENCLOSED ARC.

The report on enclosed arcs and the carbons therefor, prepared by the committee of the National Electric Light Association having this matter in charge, was one of the important features of the late convention and furnishes much food for reflection. The problem of producing a suitable carbon for such work has always been a serious one, and for a time threatened to prove almost insoluble. As usual, however, persistence met its reward, and to judge from the report in question, there would seem to be little trouble in securing from a number of makers, both American and foreign, carbons of suitable grade. The edge of one's self-congratulation is somewhat blunted, nevertheless, by the statement of Professor Matthews in response to a direct inquiry, that for a combination of life and light-giving power, the European carbons still hold first place. Considering the fact that enclosed arcs are little used abroad, and that these foreign carbons are made mostly for export, such a result is all the more remarkable. It would be interesting to know whether this advantage comes from different labor conditions, different processes or different materials, or all together. It is a matter of great finesse to make such carbons, to give them just hardness enough to ensure a good life and prevent smudging the inner globe, without sacrificing intensity or steadiness of burning. Yet we have a pretty distinct opinion that our American makers could easily turn out a carbon as good as the best product of Europe if they stood on a parity with the foreigners in cost of labor and material.

But there is much that the committee report did not include. Steadiness of burning is perhaps the most important practical quality demanded of carbons for any kind of arc lighting, and this cannot easily be made the subject of exact tests. As a general rule, the carbons that give the longest life are a bit too hard for maximum steadiness. Indeed, it is quite certain that in most instances long-lived carbons are rather at a disadvantage. It seems to us that altogether too much importance is oftentimes attached to mere length of burning. Of the five kinds of carbons tested by the committee, the longest lived sort averaged 115.6 hours, and the shortest lived 98.8 hours. That is, when used for street lighting on the winter schedule, the former would burn a little over eight days, the latter just seven. Now, the difference in cost of carbons and trimming per year for these two grades of carbon is altogether trivial compared with even a slight difference in steadiness or efficiency. Of the two, either burns quite long enough for every-day station operation, and quality of light far outweighs so small a difference in life. We omit from this comparison one brand of carbon, which lived only 85.6 hours by reason of the very great difference in clearance between this carbon and all the others. We have a strong suspicion that, as between the carbons tested, careful gauging to uniform clearance would have very materially altered the outcome. A loose-fitting carbon, as is well known to those operating large numbers of enclosed lamps, means a shortened life, and the best results are to be obtained only by using carbons of uniform diameter and caps bored accurately to size. Experience has shown that careful attention to such little details as these are absolutely necessary to the successful use of enclosed lamps. When such lamps are first installed it is a usual occurrence to hear loud complaints of the carbons not coming up to their guaranteed life, but this difficulty vanishes just so soon as the trimmers, used to dealing with open arcs, have

become accustomed to their new duties and begin to appreciate the importance of care.

We are glad to note also that the committee is taking up seriously the photometric properties of direct-current and alternating-current series enclosed arcs. These two systems often come into competition, and data for comparison have up to the present time come mostly from people with axes to grind. The preliminary report, however, seems in great measure to confirm these data as understood by those familiar with the subject. The 6.8-ampere direct-current enclosed arc appears to be perceptibly better than the 6.6-ampere alternating arc, but by no very large amount. The difference in distribution is, if anything, rather in favor of the direct-current arc, a point not generally realized. Still, the two are so close together that this advantage counts for little. The results, on the whole, confirm the opinion generally held that at 6.6 amperes the alternating arc is not quite equal in illuminating power to the 6.8-ampere enclosed direct-current arc, but yet pretty near to it. At 7.5 amperes, on the other hand, or even a trifle less, the alternating arc is distinctly better than either the 6.8-ampere enclosed or the 9.6-ampere open direct-current arc.

One thing we earnestly hope the committee will overhaul during the coming year, and that is the series-enclosed arcs, both direct and alternating, taking about 5 amperes. Their real relation as effective illuminants to the ordinary open "half arc," so-called, has never been properly determined, and it is a subject that is likely to be up for discussion in the very near future. Such lights have been used considerably in street lighting, and their equivalence ought to be carefully ascertained before their use is largely increased. The open arc seems doomed in this country, but it has done sterling service for a good many years, and its successor should be made to show entirely satisfactory credentials. We have yet to hear of a case in which the change from open to enclosed arcs was not adjudged by the public a beneficial one, but it is a good idea to know exactly what one is getting, and thorough investigation of the subject is much to be desired.

THE ELEMENTS OF PRECISION.

We wish that once, at least, during his lifetime every engineer were compelled to come down to the very foundations of things and to measure one physical constant with the utmost attainable precision. One who has been through such an experience has widened his scientific horizon for the rest of his days, and acquires a contempt for shifty and slovenly experimenting that stands him in good stead. It does not make much difference what the particular nature of the work of precision may be; it might be nothing more startling than the exact comparison of two standards of length or mass, but it would teach the lesson of the difference between real and pseudo-precision, and teach it too forcefully to be forgotten. More than all else, it would teach the futility of the last few decimal places in almost any result one can mention, and the difference between concordance and exactness. When one gets down to hard facts even our units of length, mass and time are in a state not encouraging to one's scientific vanity, and on these units hang all the others. It is a very pleasant thing to talk glibly about a precision of one part in ten million, and that sort of thing; but there are few who understand what the words imply. It is a perfectly possible thing to compare two metre bars placed side by side with such care that the difference between them is then and there known to the ten-thousandth part of a millimeter. But keep one bar in Paris and send the other to London or Berlin for comparison with a third bar, and no amount of care seems able to insure that the relation between this new standard and the original one will be known with any such accuracy. And after the lapse of a few years there is a very good chance that new determinations will not agree with the old ones. Changes as great as three or four parts in a million have been several times recorded under such conditions.

With standard of mass the case is little better. One can compare, say, 200 grain weights to nearly or quite one part in a million, but one could not be sure of repeating the measurement elsewhere and on a different balance to even one-tenth that degree of precision. And as an absolute quantity the grain is not known anywhere so closely as the figure last mentioned would indicate. Even the measurements of time are far from being such as to give one the fullest confidence in results dependent upon them, although, on the whole, the measurement of time is the most precise known to us. There are 86,400 seconds in a day, and a first-class astronomical clock has its rate kept down to about a tenth of a second per day. The rate may possibly be steady to a hundredth of a second a day for short intervals, so that if there are no errors in timing events other than those involved in the clocks, one could count on time as being measured with great precision. But it would be rash indeed to attempt to measure the time elapsing between two events an hour apart to one part in a million, or anything near that figure, while if only ordinary precautions were taken, errors of one part in 5000 might very easily creep in. When the elements of length, mass and time enter, as they frequently do, the same experiment, the chance of precision is still further diminished, and many a result derived from beautifully concordant experiments has been vitiated by a flaw in one of these basic units. If temperature also enters the result, one's case is yet worse off, for thermometry involves a series of possible errors beside which those of the fundamental units are insignificant. Most physical measurements involve thermometry, and in dealing with any complicated problem the case rapidly goes from bad to worse.

For instance, after half a century of study of the mechanical equivalent of heat, that constant is uncertain by at least one part in two thousand, and perhaps by more. We commonly comfort ourselves by considering the perfection of electrical measurements, yet the standard of e. m. f. is certainly in doubt by at least one part in two or three thousand, even as regards the permanence of the standards, while the electro-chemical equivalent of silver, which is the real basis of so many electrical constants, has not yet been determined with certainty to much, if any, higher degree of precision than one-tenth of 1 per cent. The true value of the ohm is in doubt by a similar amount, and the specific conductivities of the various metals are in far worse case. Fortunately, our working standards can be used for comparative measurements with a fair degree of accuracy, sometimes with a very high degree of accuracy, but in using them one should never forget that they are relative, not absolute measures. For most purposes it is merely relative accuracy that is needful, and there is a great work still to be done in such practical standardization as involves only these relative measurements. It is a task essentially international in its character, and we hope, now that the United States has fallen into the line of progress and established a Bureau of Standardization, for a united international effort that will bring the world's working standards to approximate unity. If this task can be thoroughly carried out, we need not worry much about the absolute values, for these will be worked out in due season. So long as one must apply corrections to the standards one actually works with, and that is presumably for all time, a slight change in the magnitude of such corrections to bring the result into accord with a new absolute determination, is not a very serious matter. Grave errors creep in most readily from the assumption that corrections are needless, for to realize errors is in great measure to avoid them.

Tremendous Trolley Boom in Pennsylvania.

The Pennsylvania Legislature passed bills last week favoring the creation of new trolley and other electric roads in the State. The effect of this legislation is noted in the following dispatch from Harrisburg, of June 8:

It was officially announced to-day that Governor Stone had signed the Emery and Focht rapid transit bills, under yesterday's date. The rush to take out charters at the State Department for street railways under the two rapid transit bills just signed began before it was officially announced that the measures had been signed. Over 100 applications were filed between 7 and 10 o'clock this morning, and it is expected the number will be doubled in the next 48 hours. Several Harrisburg law firms have been working day and night since the final passage of the bills on Wednesday, preparing applications. Secretary Griest announced this afternoon that charters had been issued to 13 street railway companies to operate in Philadelphia and suburbs. The names of the corporators and the routes of the proposed lines were not make public. The list of companies of the week is as follows: Passayunk Avenue Elevated Passenger Railway, capital $350,000; Broad Street Subway Passenger Railway, capital $1,250,000; Western Rapid Transit Street Railway, capital $360,000; Broad Street Rapid Transit Street Railway, capital $150,000; Chestnut Hill & Glenside Rapid Transit Street Railway, capital $150,000; Ridge Avenue Elevated Passenger Railway, capital $850,000; Frankford Elevated Passenger Railway, capital $750,000; Northern Rapid Transit Street Railway, capital $228,000; Germantown Avenue Elevated Passenger Railway, capital $900,000; Southern Rapid Transit Street Railway, capital $90,000; Eastern Rapid Transit Street Railway, capital $540,000; Central Rapid Transit Street Railway, capital $60,000; Market Street Elevated Passenger Railway, capital $1,500,000.

Charters were also granted to the companies in which Messrs. Oliver, Bigelow and other Pittsburg men are interested. The capital stock of the companies and the list of corporators are not given. The State will receive a handsome revenue from these charters. The fee for taking out a charter is $82, in addition to the bonus of one-third of 1 per cent on the authorized capital stock of the corporations. The new laws go into effect immediately.

The New York bankers said to be interested in the project are Kuhn, Loeb & Co and Moore & Schley. The best-known of the Pennsylvanians interested are United States Senators Quay and Penrose, James M. Guffey, Henry W. Oliver, Judge Reed, president of the Philadelphia Company; Thomas S. Bigelow, Richard R. Quay, John M. Mack, Congressman Foederer, and the Mellons, of Pittsburg.

Annual Meeting of the New York Electrical Society.

The New York Electrical Society held its twentieth annual meeting on June 6 at Café Boulevard, in New York City. The meeting was preceded by a dinner, and was followed by a concert. No fewer than 110 members and friends were present, and the evening was a great success. The report of Treasurer Sinclair showed that during the year a deficiency of about $200 had been converted into a balance of about $81, and that the receipts of the society in the year had reached $882.50. Secretary Guy reported that the activity and interest in the society had been maintained at a high level. Among the contributors to the programme had been Mr. Carl Hering, Dr. Kennelly, Mr. C. P. Steinmetz, Dr. S. Sheldon, Mr. K. B. Miller, Dr. Louis Bell and Mr. C. F. Scott, and the society had also visited the central station of the New York Edison Company and the new automobile stables of the New York Electric Vehicle Transportation Company. The average attendance had reached the high figure of 200 per meeting, which probably had not been equaled by any other technical society in the city during the year. The gain in membership had also been quite remarkable. The society had begun the year with 540 members, 90 new members had been elected, 1 had died, 2 had been stricken off the rolls and 16 had resigned. This left a total for the beginning of the new year of 611, showing a net gain of 71 members. During the evening 6 new members were elected.

An interesting feature of the year's work had been the publication of no fewer than three of the lectures, that by Mr. Miller on telephone engineering, and those by Messrs. Steinmetz and Scott on alternating current work, for all three of which there was a large demand.

The society adopted a new constitution and then proceeded to the election of officers for the year 1901-2, and the ticket was unanimously elected as follows: President, Arthur Williams; vice-president, C. E. Knox, re-elected; C. O. Baker, Jr., re-elected; S. L. Nicholson, re-elected; H. A. Lardner, George Harbert Condict, H. V. Parsell; secretary, George H. Guy, re-elected; treasurer, Henry A. Sinclair, re-elected.

Ex-President Dunn then spoke of the highly successful season that the society had had and called for a rising vote of thanks to the retiring president and his associates for their active and effective administration. This having been done the society proceeded to listen to an excellent programme of music arranged by Secretary Guy, which lasted until 11 p. m., and was greatly enjoyed. One of the contributors was Mr. C. McL. Paine, who was formerly in the electrical field, but has of late made quite a reputation as a vocal artist. Among the selections rendered by Mr. Paine was the prize song from the Meistersinger. It was agreed on all hands that the dinner and concert furnished a charming finale for one of the best years that the society has ever had, and afforded a pledge of vigorous and united work in the future. The new president, Mr. Arthur Williams, made a brief and earnest acknowledgment of the hearty reception given him and assured the members that very effort would be put forward to maintain the society on the high plane which had now been reached.

The following were elected to membership: John A. Jamison, Jr., 170 Paterson Street, Paterson, N. J.; W. B. Larrabee, Knickerbocker Telegraph & Telephone Company, 100 Broadway, New York; Andrew Adam Schwinn, Jr., 1463 First Avenue, City; Emerson C. Tibbals, Electric Hydraulic & Pneumatic Power Station, U. S. Naval Magazine, Iona Island, N. Y.; C. Baechtold, Rossiter, McGovern & Co., 16 Morris Street, Jersey City, N. J.; Marcellus Staley, 327 West Fifty-second Street, City.

PRESIDENT ARTHUR WILLIAMS.

Arthur Williams was born Aug. 14, 1868. He entered the employ of the Edison Electric Illuminating Company February, 1885, at the old Pearl Street station. His first intention was to take a naval course at Annapolis, but seeing the great future then opening out for the electrical industry he determined to accept even a subordinate position with the Edison Company. So great was the difficulty of securing a place in the company at that time that he was content to take a place as an assistant in the meter department. Subsequently he was appointed electrician of the company, and afterwards became superintendent in charge of one of the uptown districts. This was in 1888. In the following year he was made superintendent of construction. In 1890 he was appointed general inspector. In 1893 this office was combined with the general agency, and under that form has since been held by Mr. Williams.

PRESIDENT ARTHUR WILLIAMS.

Not only is Mr. Williams' practical knowledge of the various branches of central station operation held in the highest esteem in electrical circles, both here and abroad, but he has made several notable contributions to the literature of the industry. At the Detroit meeting of the Edison Association in 1896 he read an able paper on the relations of the electric supply companies to their customers. In 1899, at the annual meeting of the American Institute of Electrical Engineers at Saratoga, he replied at length to a paper which had been read before the American Institute of Electrical Engineers on isolated electric light plants. The purpose of this reply, which was exceedingly lucid and comprehensive, was to clear up many existing misconceptions as to the relative advantage of the central station service. This contribution, owing to the data which it contains and the able manner of their presentation, remains perhaps the most important in the literature of the subject. In 1900, at the Saratoga meeting of the Edison Association, he read an exhaustive paper on electric elevators, in which the historical side of the industry was treated, as well as the relative efficiency and economy of electric elevation and of other methods.

In 1899 Mr. Williams was elected vice-president of the New York Electrical Society, in whose councils he brought to bear the same energy and judgment which have characterized his commercial career. Mr. Williams' election as president is most gratifying to all sections of the membership of the society, who regard it as insuring the continued activity and success of the organization.

Chaudiere Falls Power Transmission Plant.

By R. GIROUARD.

THE Chaudière River takes its rise in the mountains on the border of the Province of Quebec and the State of Maine. It drains an area of about 2200 square miles, and on account of the denuded state of the watershed as well as the rapid slopes to the river, is subject to rapid and extraordinary fluctuations. The minimum flow of the river in summer months is 35,000 cubic feet per minute. The winter flow shows a very much higher average for the area drained than in the case of the northern rivers flowing into the St. Lawrence. At the point where the plant is located, to which this article relates—about 9 miles above the city of Quebec—the river falls down a perpendicular cliff of about 95 ft., and then reaches the St. Lawrence, 2 miles below, by a series of rapids aggregating 60 ft. in height.

HYDRAULIC DEVELOPMENT.

As will be seen by the small map of Falls and surroundings (Fig. 2), the conditions existing at the Falls for an easy and inexpensive development were ideal. The small channel shown to the right of the island was at all times, except during high freshets, free from water. This channel ran for a few hundred feet below the head of the

FIG. 1.—GENERAL VIEW OF POWER HOUSE.

island, when it, like the river, plunged through a gully some 800 ft. long and almost at the level of the water below the Falls.

At the point immediately where the channel made its descent to the lower level, the gully widened out sufficiently to allow the power house to be built, as well as room for three 8 ft. 3-inch flumes, which it is intended to use when the full power of the Falls is utilized. It will thus be seen that the problem resolved itself in the blocking of the inlet at the island by a bulkhead, and building a suitable dam at some distance above the Falls, to act as a regulating pond in case of exceedingly low water. For reasons that are apparent by looking at the map, the dam was carried across the river some 150 ft. above the Falls and a wing dam built at right angles to the main dam, connecting that part of the work with the bulkhead.

The main dam from the eastern abutment to the point where it connects to the wing dam is 824 ft. long, with an average height of 19 ft. on a base of 20 ft. This dam, as well as all other works connected with the water development, was built of concrete composed of cement one part, sand two parts and broken stone four parts. The foundation of the dam was carried well into the rock, the concrete being placed on a thick bed of cement motar after the bedrock had been thoroughly scrubbed from all adhering dirt. From the main dam the wing dam was carried down 159 ft. to the bulkhead, the crest of the wing dam being at the same level as that of the main dam.

The bulkhead which closes the inlet of the small channel is a massive structure of concrete 120 ft. long and 30 ft. wide at the base, and connects on the western shore of the river to an earthen embankment with a concrete core wall, this last being carried some 200 ft. up the river and then running into a side hill some 300 ft. from the original river bank. The bulkhead is provided with three inlet cones which pass through at the base, one of these being connected to the existing flume. The center of these cones is 15 ft. below normal water level. The rack and headgates are in front of this bulkhead, steel being the only material employed in construction of this part of the work.

The flume, of a diameter of 8 ft. 3 inches, and supported on steel

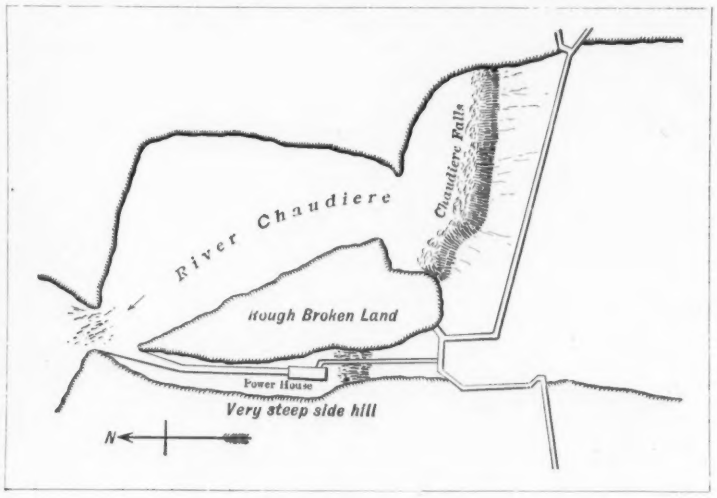


FIG. 2.—MAP OF CHAUDIÈRE FALLS.

piers, runs 175 ft. from the bulkhead, then dips at an angle, finally ending at the power house at floor level and at a distance of 340 ft. The tail race, which extends 800 ft. from the power house to the end of the island, is partly natural and partly artificial. The difference of level between still water in the pond at dam and in tail race is 115 ft., affording a working head of about 112 ft.

POWER HOUSE.

The power house is built partly over a concrete arch which spans the tail race, and partly over natural rock foundation. It is a steel-

framed brick building, 80 by 50 ft., with steel truss roof. It is provided with a 15-ton traveling crane, capable of reaching any part of the building. The floor of the building is of concrete, ducts having been provided to carry cables from dynamos to switchboard. Floor of power house was not yet completed when photographs were taken.

The power house has been planned for an ultimate capacity of 5000 horse-power. At present the plant consists of two 1400-hp and two 50-hp waterwheels, made by the S. Morgan Smith Company, of York, Pa. The larger wheels are directly connected to two 750-kw, three-phase 10,500-volt generators. The smaller wheels are directly connected to two 30-kw direct-current dynamos, which serve as exciters. Governing is obtained by two Lombard governors on the larger wheels and by common pawl governors on the smaller wheels. To ensure uniform pressure of water on the waterwheels under variations of load and also to provide for water hammer, the flume is fitted with two 15-inch Lombard relief valves, which open when the pressure exceeds the static head by a few pounds, thereby relieving the flume of any dangerous pressure caused by sudden closing of the waterwheel gates.

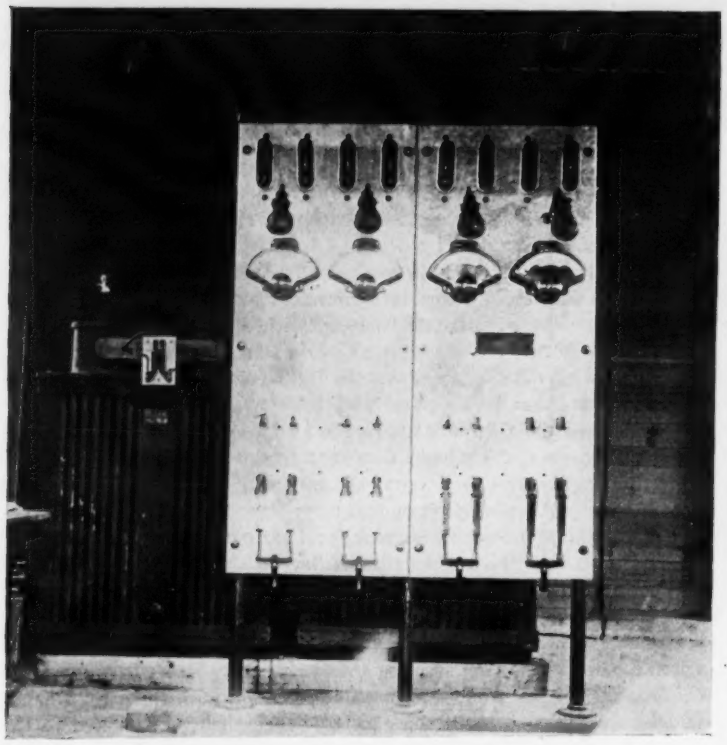


FIG. 3.—LEVIS SUB-STATION.

The generators are of the revolving-field type, three-phase, with a normal voltage of 10,500, but capable of being raised to 11,600 volts. The speed is 400 r. p. m., and the periodicity 66.6. They are single-slot machines, and show a regulation of 7 per cent on non-inductive load. The exciters are compound 30-kw machines, wound for 120 volts at a speed of 950 r. p. m.

The switchboard, of blue Vermont marble, is provided with the usual current and potential transformers as well as a three-phase static ground detector. Oil switches are used for opening circuits of high potential. Fuses on the generators and line are of the spring expulsion type, and Wirt lightning arresters are connected to the line inside the building. All electrical material inside the power house was made by the Canadian General Electric Company, of Peterboro, Ont.

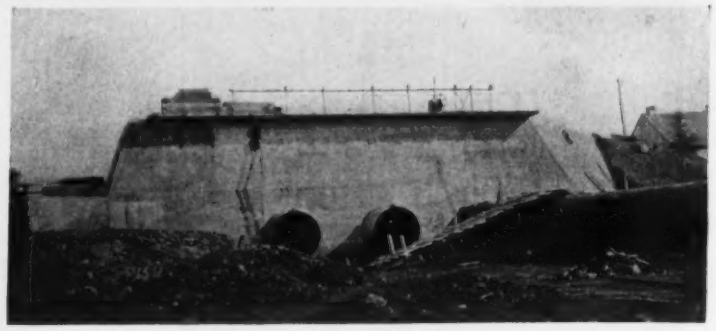
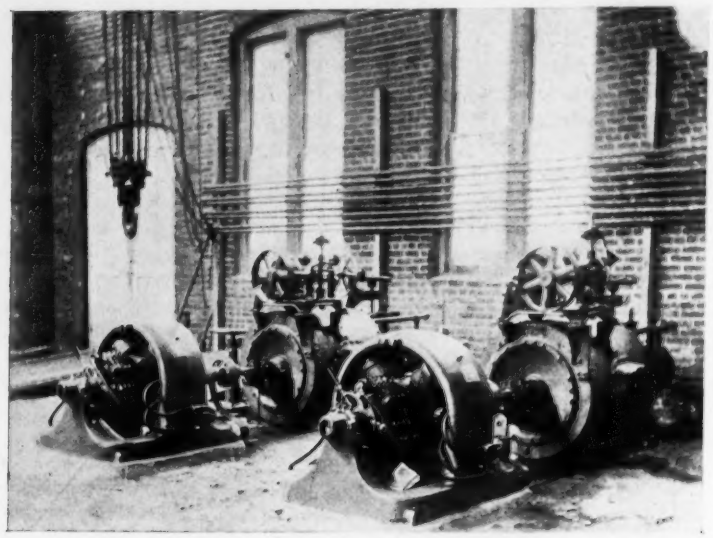


FIG. 5.—INLETS THROUGH BULKHEAD.



FEB. 6.—EXCITERS AND TURBINES.

TRANSMISSION LINE.

This extends from the power house to the city of Levis, nine miles away. Poles are of cedar, 35 to 45 ft. long, and with 7-inch tops. The pole line is designed to carry three circuits of three wires each for four miles (one circuit being connected to a sub-station at that distance), and two circuits for the remaining distance of five miles. In the first case two four-pin cross arms are used with a cast-iron pole cap serving to carry the ninth wire. For the last five miles one two-pin and one four-pin cross arm are used, allowing the formation of

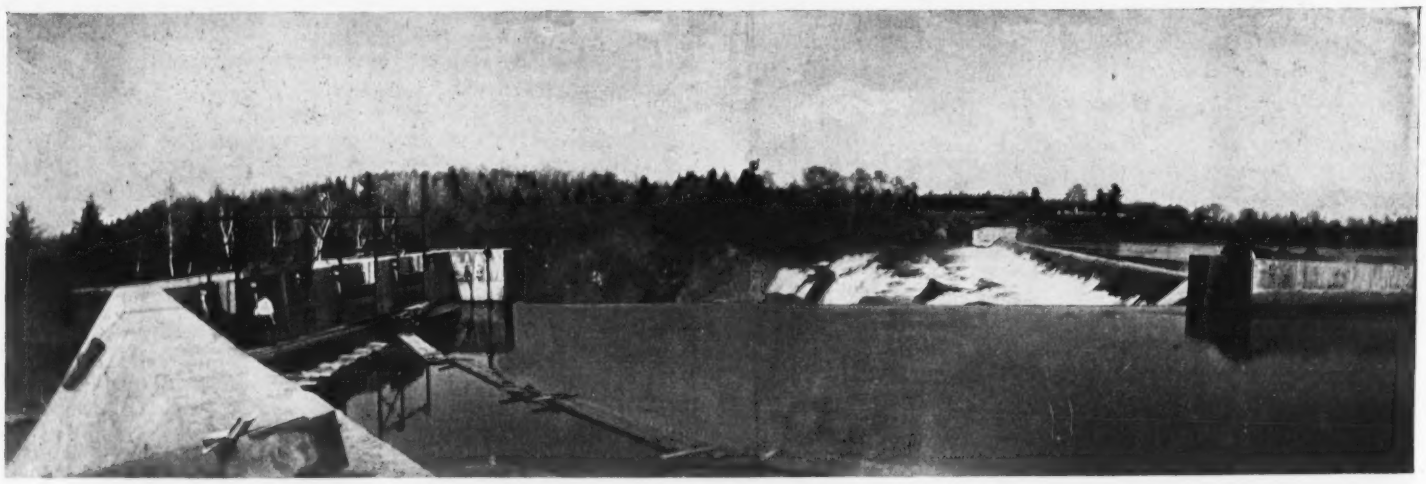


FIG. 4.—GENERAL VIEW OF DAM AND FALLS, WITH BULKHEAD IN FOREGROUND.

two triangles. Poles are spaced 100 ft. No. 4 medium drawn copper is used on the circuits.

There are two long spans on the line, one 500 ft. long over the River Chaudière a few hundred feet from the power house, and another of 300 ft. over the Etchemin River. In the first case hard drawn No. 1 wire is used, and the problem of anchoring and insulating the end of the wires was solved by bringing the wires a complete turn over an 8 by 10-inch beam, and tying the free end to the wire spanning the river, the wire in its turn over the beam being supported by porcelain insulators of triple petticoat pattern. The object of making the complete turn around the beam was to obtain a compressive strain on the insulators instead of the usual side strain, which, with the span in question, would have sheared the tops of any insulator. The strain is also evenly distributed, a condition never obtained where the insulators are in series. The span over the river Etchemin is made in the ordinary way, the wire on this being smaller and distance less.

SUB-STATIONS.

There are two sub-stations, one at Levis and the other at Etchemin. The first is provided with two three-phase—two-phase 150-kw oil-cooled transformers made by the Westinghouse Company, and reducing the pressure from 10,000 volts to 2080 volts. This station is also provided with a small distributing switchboard, consisting of two panels with ammeters, circuit breakers and expulsion fuses of four 100-kw circuits. The Etchemin sub-station is provided with a duplicate equipment of the Levis station, but for one-half the capacity.

All secondary distribution is on the three wire system, using large pole transformers, oil insulated, and made by the Pittsburg Transformer Company.

The population to be served by this plant is in the neighborhood of 20,000, and it is probable that the number of lights wired may reach one per capita, a figure reached and passed by many Canadian lighting companies. The field for the sale of motive power is also a large one, and should yield a good revenue.

The plant is the property of the Canadian Electric Light Company, of Quebec, of which the Hon. L. P. Pelletier, also of Quebec, is president.

The work of development on this plant was commenced at the end of August, 1899, and carried out under the general supervision of the writer, assisted by A. R. Henry, M. E.; T. Pringle & Son, of Montreal, being engineers for the hydraulic part and architects of the power house building.

FIG. 7.—INTERIOR OF POWER HOUSE, SHOWING 750-KW GENERATOR, TURBINES, GOVERNOR AND SWITCHBOARD.

Photography and Telephony.

In a recent interesting article in the New York *Sun* reviewing the progress of photography during the nineteenth century, the veteran photographer, Mr. George D. Rockwood, records the following experiments, which apparently have reference to the old transmitter "make-and-break" controversy, as between Bell Reis and others:

Our wonder is often excited by seeing photographs of waves in motion made so quickly that they are apparently still, and of horses jumping in the air, and by the wonderful biographic pictures now reproduced so successfully. The experts who take these pictures say that they are made in a 250th part of a second, but this is slower than the growth of a pine tree compared to some pictures.

I was consulted in a patent case, and the inquiry was made as to whether it was possible to illustrate by photography the following case: One of the claims of the telephone patent is the continuous wire attached to the diaphragm of the speaking tube. This party declared that he could sever that wire and evading the patent produce the proper effect.

Wheatstone measured the duration of the electric spark as one twenty-four thousandth of a second. It would follow that any vibration not quicker than this might be arrested on the photographic plate at any point in its travel. Whereas, according to the investigations of Plateau, the duration of successive impressions on the human eye will average half a second, the electric spark might separate and distinguish photographically waves of which 12,000 impinge on the retina while the first of them is still lingering there. Now the vibrations or waves of air that yield the respective tones or pitches of sound have been accurately measured and counted. Assuming the pitch of the ordinary masculine voice in conversation to be as low as middle C, the number of complete double vibrations imparted by such a voice to the telephonic diaphragm or typmpanum would be 256 a second; that is, counting both ways, 512 movements of the diaphragm with its metallic point making or breaking the electrical circuit at each movement.

To the eye, which retains every impression for half a second, 256 of these movements would make their impression as one, and would give a stationary, fictitious image, if they were of sufficient depth to produce any visible effect whatever, which they are not. The electric spark, however, would give its illumination and do its photographic work within a little more than one-fiftieth of the time of

one of the tympanum movements. A succession of such photographs, therefore, would present fortuitously any position of the vibrating point from that of contact to that of extreme reaction with an indefinite number of intermediate positions.

To verify these calculations I carefully focussed the photographic camera on the points of the telephone by daylight, and a battery of Leyden jars was so adjusted that when discharged it would throw the proper illumination on the points. My instantaneous plates were now to be tested under action 500 times quicker than a sensible instant and also invisible minute. Of course, it was as yet a practical question whether the photographic plates could effectively receive as quickly as the electric spark would give this infinitesimal action of light.

Waiting until the darkest hour of night, the plate was uncovered in total darkness, the telephonist began speaking into his instrument, and the illuminating spark was flashed upon the points. This operation was repeated with more than 20 plates in succession. The resulting negatives, on being developed, proved a triumph in two arts and a science. The photographs printed from them showed under the powerful magnifying glass, in some, contact of the points, and in others a variety of infinitesimally differenced intervals between them. Not one of the impressions had more than the one-twenty-four thousandth of a second in which to be begun and ended.

Prof. Bell on the Telephone.

The subjoined, with the signature of Professor A. G. Bell, has been issued by the Press Publishing Company, of the *New York World*, in which it appeared on June 9:

It is exactly 26 years since I put up my first telephone. At that time I was visiting at my father's house in Brantford—a small city in Ontario, Canada. We obtained the permission of the Canadian Government to use a telegraph line four miles long that extended from Brantford to a neighboring village. We put up our apparatus in a friend's house, kindly loaned for the purpose, and as it was over half a mile from the telegraph line, we were obliged to lengthen the wire. No additional telegraph wire was available, so what do you think we used? You would never guess. We could find nothing in the hardware stores but stovepipe wire, and we had to buy up all the stovepipe wire in Brantford to make our line long enough. We did not trouble to put up posts, but tacked the wire to the fence. The communication that took place over this first telephone wire was not a conversation, but a monologue, as we had the transmitter only at one end and the receiver at the other.

In this way the first message was sent over the telephone, and I have been told that Brantford calls itself the "Telephone City" ever since. That was in 1875. A short time afterward Mr. Charles Williams, of Boston, strung a telephone wire from his office in Boston to his house in Cambridgeport, a distance of two miles. This was the first telephone wire to be permanently erected.

Since those small beginnings, what amazing progress has been made! Do you know that there are nearly 2,000,000 miles of telephone wires in the United States alone? If these wires were fastened together they would encircle the earth 81 times. The total number of telephone calls in this country last year was 1,820,000,000. At the rate of 1 cent per call this would amount to enough pennies to form a double row around the globe, and there would be enough left over to make three rows across the Atlantic. And all this has been accomplished in a single generation.

I have recently been traveling through Norway and Sweden, and I was surprised to note the wonderful progress made by the telephone in those countries. In proportion to the population there are more telephones in Norway and Sweden than in any other country, even in America.

The next great step in the improvement of the telephone will be wireless telephony. This is not an inventor's dream. It has already been done across short distances. In the immediate future it will be made practical for social and commercial purposes.

Roentgen Society of the United States.

The second annual meeting of the Roentgen Society of the United States will take place in Buffalo, N. Y., Sept. 10 and 11, 1901, at the University of Buffalo. Applications for membership may be addressed to Secretary J. Rudis-Jicinsky, M. D., Cedar Rapids, Iowa, or to Dr. E. A. Florentine, Saginaw, Mich.

A Rotary Field Electrostatic Induction Motor.

The March issue of the *Journal* of the Institution of Electrical Engineers of Tokyo, Japan, contains an interesting paper by Professor Hidetaro Ho on a new type of rotary field electrostatic induction motor, the non-mathematical portion of which we reprint below:

In 1888 Professor Galileo Ferraris demonstrated in his famous researches on "Rotazioni Electrodynamiche," that by the combination of two simple alternating magnetic fields at right angles and differing in phase by 90 degs., a rotating magnetic field can be generated, and that by means of this resultant field, Arago's historic and classic experiment could be realized. In one of his fundamental experiments he showed also that an iron cylinder rotates in a rotary magnetic field, even when it is cut in such a way that no eddy currents can be produced, and he remarked that the rotation in this case was due to magnetic hysteresis—that is to say, to the lagging of the magnetization of iron behind the rotation of the magnetic field. Tesla's earlier motors also worked upon the same principle, notwithstanding his erroneous attribution of the cause of the torque. Even now this phenomenon is sometimes made use of in starting synchronous machines.

The analogy existing between the behavior of dielectric bodies in an electrostatic field with that of a magnetic body in a magnetic field suggested to Steinmetz that in dielectric media in an electrostatic field—for instance, in the insulating medium of a condenser which is alternately charged and discharged—a consumption of energy takes place, which depends upon the intensity of the electrostatic field according to a law similar to that of magnetic hysteresis. To determine this loss of energy and its dependence upon the e. m. f., he made in 1892 a number of tests with a condenser with paraffin paper as insulating medium, and obtained the result, $H = k E^2$, where H is the dissipation of energy by electrostatic hysteresis, E the electric intensity and k a coefficient.

The existence of hysteresis effect in dielectrics, together with the hysteresis motor of Ferraris and Tesla cited above, naturally suggest the possibility of constructing an electrostatic motor upon quite a similar principle, substituting for the rotary magnetic field a rotary electric field and for the iron cylinder one of a dielectric substance. This was first done in 1893 by Riccardo Arno, the able disciple of Ferraris himself. A glance at Fig. 1 is sufficient to understand his arrangement. *a*, *b*, *c*, *d* are four metallic segments fixed on an insulating base, and enclosing the space in which the rotating electric field is to be produced. *H* is a hollow cylinder of mica or paraffin paper, suspended co-axially to act as the rotor. Arno obtained two potential differences differing in phase by 90 degs. by means of an inductance and a condensance in series in the secondary of a step-up transformer, which were applied to each of the pairs *a b* and *c d*, thereby causing a rotary electric field in the space enclosed. As was expected, the hollow cylinder was set in motion in the direction of the rotation of the field. Using an ebonite cylinder, 139 mm. long and 61 mm. outside diameter, a torque of 18 gramme-centimeters was obtained at starting.

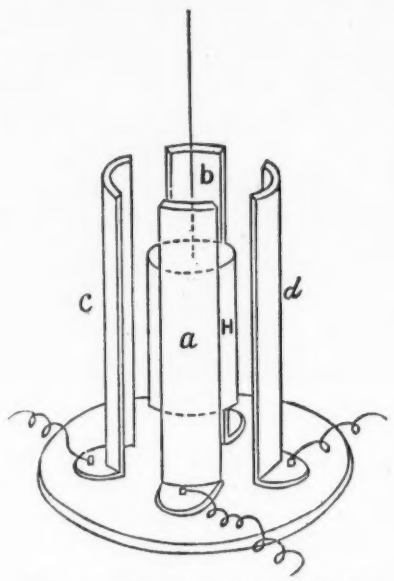


FIG. 1.—STATIC INDUCTION MOTOR.

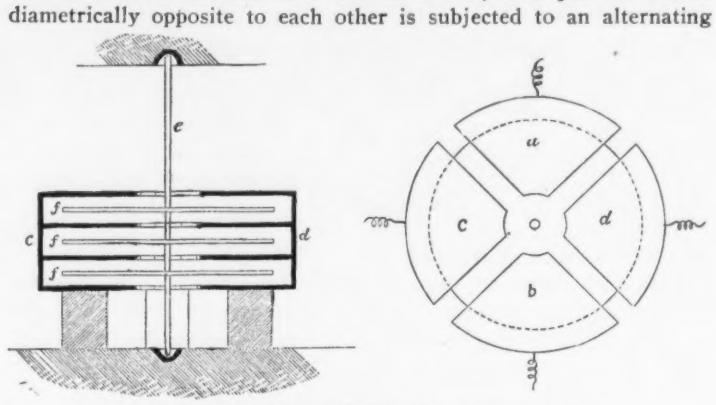
The writer constructed in the Electrical Engineering Laboratory of Tokyo Imperial University in 1894 a model of an electrostatic motor on quite a different principle, which ran successfully, as reported in the issue of the *Transactions* of the Institution of Electrical Engineers of Tokyo of January, 1895.

The stator consisted of four multicellular quadrants, and the rotor was composed of several circular paper disks mounted on a common shaft, and moving as the indicating element of an ordinary quadrant electrometer, there being one disk in each layer of cells. The cross section and the plan of the motor as set up are given in Figs. 2 and 3,

in which *a, b, c, d* are quadrants mounted on insulators, *e* is the shaft of the rotor carrying three paper disks *f, f, f*.

Each disk carries 24 sectors of tin foil arranged radially, each of which is insulated from the rest, except at the inner, where all the sectors are put in communication through radiating pencil lines, as shown in Fig. 4.

The principle upon which the above motor was expected to work was as follows: As the electric field rotates, each pair of sectors diametrically opposite to each other is subjected to an alternating



FIGS. 2 AND 3.—CROSS SECTION AND PLAN OF MOTOR.

e. m. f., which would produce, if the sectors be absolutely insulated from each other. induced charges in these pieces of tin foil, which charges would appear and disappear simultaneously with the potential differences impressed by the stator, and therefore no torque can be developed. If, on the other hand, the sectors be connected up with small resistances, a very considerable amount of equal and opposite induced charges would appear on the two sectors of a pair, and a considerable attraction between the quadrants and the disks would result; no tangential pull, however, can be obtained since the induced charges appear and disappear simultaneously with the potential difference of the stator. If, however, the resistances have a certain proper value, we may expect such a condition that the flow of charge in the process of induction and neutralization is retarded by the resistance; consequently the charge of a sector would lag behind the rotating potential difference of the stator, in which case a certain torque must be obtained in the direction of the rotation field. This was fully borne out by experiments. The disks rotated with a high speed, though I did not ascertain the amount of the torque developed.

Afterwards, in 1899, Arno seems to have also adopted the sectorial form of the stator. He uses three sectors excited by three-phase e. m. f.'s, with a suspended dielectric disk, which forms the rotor, the source of torque being electrostatic hysteresis as formerly. I understand that an arrangement quite similar to this was brought out by Dell in America about that time.

It was only some time after my first experiments that I became acquainted with Arno's paper, otherwise I would have undertaken some investigations to distinguish between the torque due to the hysteresis and that caused by the retardation of electrification, and thereby firmly establish my theory. During these four years I was otherwise occupied, and it was only a month ago that I could return to the old subject, and the following experiments were performed.

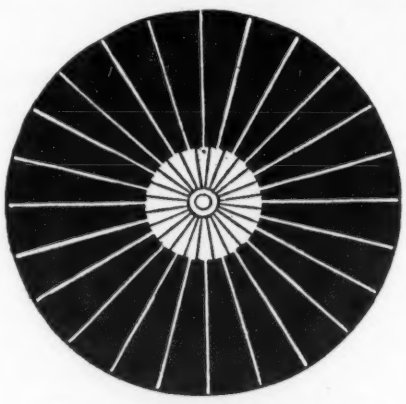


FIG. 4.—SECTOR CONNECTIONS.

Two rotors each consisted of three disks of cork 5.3 cm. in diameter and 2 mm. in thickness. On the peripheries of the disks were attached 18 zinc sectors 28 cm. in length, and insulated from one another as shown in Fig. 5, making the diameter over all about 10 cm. As stator, the multicellular quadrants of the former experiments were again employed, the method of exciting them being also as before, namely, by means of a Wimshurst influence machine to which a battery of Leyden jars was connected as a reservoir, and employing a revolving commutator worked by a small direct-current motor. The revolutions of the rotors and also that of the commutator were recorded by a delicately adjusted Morse inkwriter and a make-and-break device on their shaft, by which means the speed of the rotor and the frequency of the impressed e. m. f.'s were determined with tolerable precision. The torque at standstill was measured by means of a spiral spring, and the torque, while in motion, by means of a spring and balance weights on the ordinary dynamometer principle. The torques of the mechanical friction were also measured and added to the load—the torque in the following results being therefore to be understood as the actual torque of output plus the torque of friction. The maximum potential difference was kept at about 8000 volts and the frequency at 11 per second, through the experiments.

TABLE I.

Torque.	Slip.
.02 gramme cm.	.02
.30 " "	.19
.35 " "	stopped.
Starting torque, .13 gramme cm.	

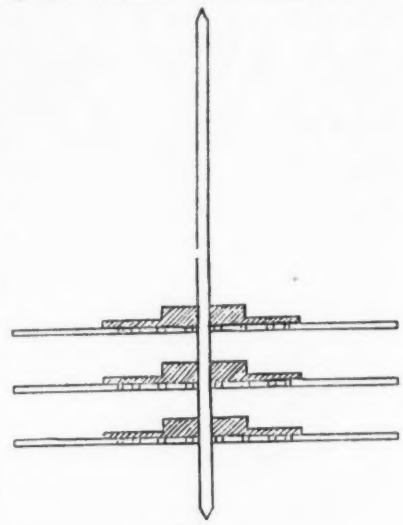
First, we put on the rotor with cork only, and the results were as shown in Table I.

Secondly, the rotor with zinc sectors was tried and the result was as shown in Table II.:

TABLE II.

Torque.	Slip.
.21 gramme cm.	10
.42 " "	Stopped.
Starting torque, .25 gramme cm.	

Next, the rotor was thoroughly moistened with water, thus destroying the insulation between the sectors, and I could obtain no torque at all. It was then put in a stream of air, and partly dried until the moisture was hardly perceptible, when a great amount of torque was obtained, as may be seen from Table III.:



After this experiment the rotor was completely dried in a stream of hot air, after which the torque and the slip returned again to the values of Table II.

The above results, I believe, fully show the correctness of the principle upon which my model has been constructed. The case of Table II. corresponds in analogy to an ordinary polyphase induction motor with a secondary of infinitesimal resistance; Table III. the same with a certain resistance inserted in the secondary, while Table I. is the case of a hysteresis motor. I call attention to the great increase of the starting torque and also of the slip in Table III.

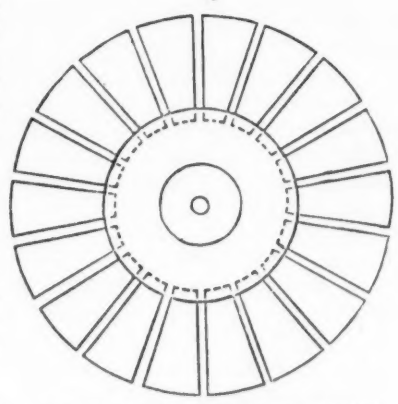


FIG. 5.—ARRANGEMENT OF SECTORS.

The model being a mere toy, I did not plot torque or load curves, but was contented with having shown the possibility of constructing an electrostatic motor upon an analogous principle to that of an ordinary polyphase induction motor. I intend, however, to construct one which is capable of developing a finite amount of power and may be really called a motor.

To show that the moisture has little to do with the hysteresis of the cork, I tried the rotor of cork when completely moistened, which gave no torque, of course, and also when it was partly dried, the Table IV. being the results in the latter case.

A considerable portion of Professor Ho's paper is devoted to the development of a mathematical theory of the motor described. The final equations are compared with those for an ordinary bipolar two-

TABLE III.

Torque.	Slip.
.21 gramme cm.	.51
.42 " "	.84
1.14 " "	.89
1.30 " "	Stopped.
Starting torque, .71 gramme cm.	

phase motor, and a striking similarity is manifested, the formulas for the one being capable of derivation from the other by a simple substitution.

In conclusion, Professor Ho says that as the addition of closed circuits in the iron core of the secondary was a great advance in the

TABLE IV.

Torque.	Slip.
.02 gramme cm.	.32
.28 " "	Stopped.
Starting torque, .17 gramme cm.	

construction of the ordinary polyphase induction motor, in the same measure his electrostatic motor is much superior to the simple hysteresis motor of Signor Arno.

White Lead by Electrolysis.

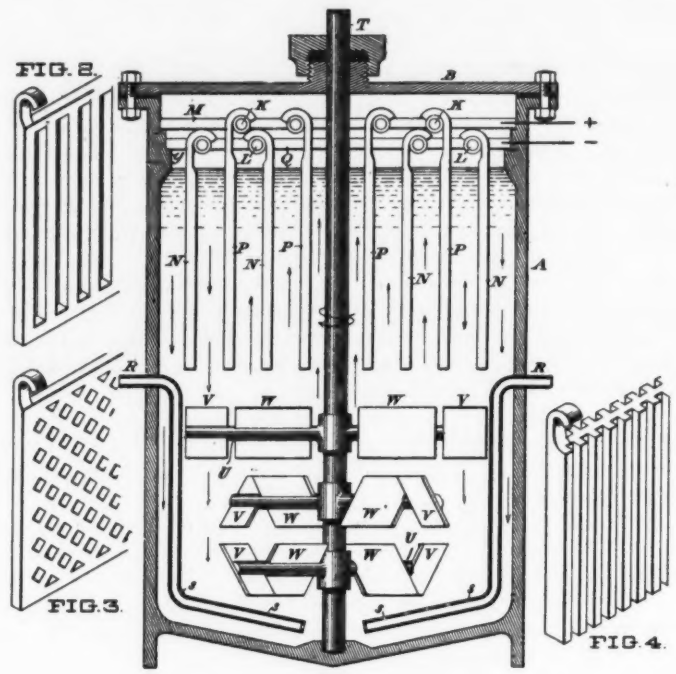
The activity of inventors with regard to the electrolytic production of white lead is attested by the fact that the issue of June 4 contains no fewer than four patents for improvements along this line.

The first embodies the suggestion, due to John Bleeker Tibbits, of Hoosick, N. Y., that the color of electrolytically produced basic carbonate of lead (white lead) may be modified by associating with the usual lead anodes, supplemental anodes of copper, whereby the lead salt is mixed with some basic carbonate of copper, which imparts to it a blue tint of which the depth depends upon the relative areas of the respective anodes; or for the same purpose suitable aniline dyes may be dissolved in the electrolyte. By reason of the earlier publication of the foreign patents this idea has been before the public for some years.

Two patents to John A. Yunck, also of Hoosick, cover respectively a process and an apparatus, the former representing to some degree a return to the old Dutch process, for instead of injecting carbonic acid gas into a solution wherein lead salts are electrolytically produced, or of carbonating previously formed hydrate of lead, there is added to the electrolyte an organic acid capable of breaking down under the action of the current with the formation of carbon dioxide, whereby, as in the Dutch process, the production of the basic carbonate proceeds directly, in a single reaction, and entirely at the expense of the electrolyte. As in the Tibbits patent, supplemental anodes are used in addition to the usual anodes of lead, but in the present case these supplemental anodes are of carbon, and it would appear that their main junction is to determine the decomposition of the oxalic or other organic acid present with evolution of carbon dioxide. The whole process is closely analogous to that patented about a year ago to Professor Joseph W. Richards and Charles Roepper, differing mainly in the means employed for decomposing the organic acid, Richards and Roepper relying upon the use of definite current densities. The obvious objection to these processes is the use of such relatively costly chemicals as acetic and oxalic acids for the mere purpose of furnishing carbonic acid gas to the bath.

Yunck's apparatus is an electrolytic cell, designed particularly for carrying into operation the process for the manufacture of white lead invented some years ago by Turner D. Bottome. As here illustrated it consists of a sealed vat, *A, B,* Fig. 1, having hung in its upper portion from the superposed grids, *K, M* and *L, Q,* alternate anodes and cathodes, *P* and *N,* preferably of such open forms as are shown in Figs. 2, 3 and 4, and at the bottom the usual injection pipes, *R, s,* for carbonic acid gas. Immediately below the anodes is placed a very efficient agitator, driven by a central shaft *T,* and carrying upon transverse arms, *U,* a series of vanes, *V, W,* oppositely inclined to induce counter-vailing currents of electrolyte and to insure that no change in the character of the precipitate shall arise from the impoverishment of the solution immediately surrounding the electrodes.

The Bottome process above referred to consists simply in electrolyzing, with electrodes of lead, a solution of mixed nitrates of sodium and ammonium, due regard being paid to temperature and current density, and the solution being kept saturated with carbon dioxide. Whether the operation be thus conducted, or whether the solutions of lead nitrate and caustic alkali produced at the anode and cathode respectively be maintained separate by porous diaphragms, to be afterward mixed and carbonated as in the later processes of Browne and Chaplin, difficulties arise from the formation within the bath of basic compounds of lead with the lower oxides of nitrogen—nitrites and hyponitrites. The fourth patent of the present issue, granted to Edwin D. Chaplin, of Winchester, Mass., and Henry G. Halloran, of Boston, is directed mainly to overcoming this defect, and consists in adding to the sodium nitrate solution in the anode compartment of a partitioned cell, a certain amount of sodium chloride. Lead anodes are used, and the lead nitrate, which is formed upon passage of the current, is at once transformed to chloride, which is



WHITE LEAD BY ELECTROLYSIS.

kept in solution by heating the electrolyte. Continued action of the current oxidizes this chloride of lead to chlorate, with perhaps some intermediate oxychlorides. From this hot solution white lead is precipitated by means of an alkaline carbonate obtained by injecting carbonic acid into the cathode solution.

The electrolytic white lead processes are eminently *cyclical.* Carbonic acid, lead and water enter into the composition of the pigment, but as these substances are always present in excess or are continuously added, the electrolyte is regenerated constantly, and the operation proceeds regularly and without production of any by-product other than hydrogen, and this is available for heating the solutions. In the last-described process, for instance, the precipitation of the pigment leaves the solution practically unchanged in composition, and ready for immediate return to the cycle. There is no class of processes, however, which it is less safe to commend because of the specious simplicity of the cycle, or to condemn by reason of the apparently needless complexity or cost. The question is whether the pigment is obtained in the form of the globular, transparent, colloidal aggregates which exhibit toward oils those peculiar relations which are designated collectively as "covering capacity," or as minute crystals, which, however finely divided, are yet crystals, hard and unabsorbed. It would seem that the precise conditions which govern the separation of the absolutely amorphous precipi-

tate have never been determined with exactness. It is to be hoped that future work, along the lines of the modern physico-chemical theories, will lay bare these conditions; and it can scarcely be doubted that when this shall have been done the electrolytic processes will supersede all others.

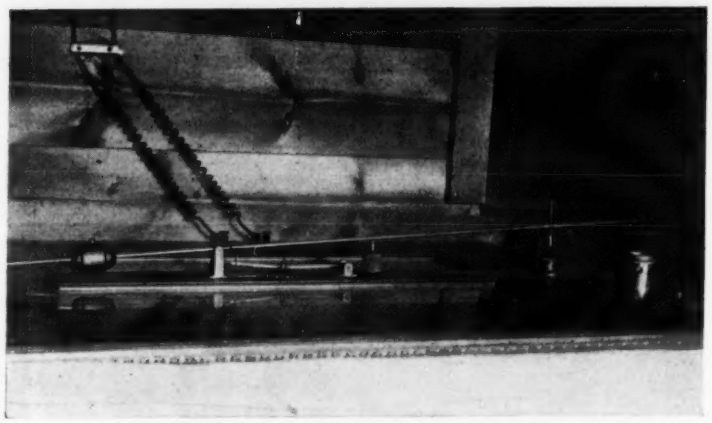
Incubation by Electricity.

BY EDWARD E. SHELDON.

SINCE the hatching of an egg results from the application of heat, it makes little difference whether this heat is supplied by the hen or by artificial means. It is claimed for the artificial method that the chicks can be produced so as to be ready at the time when prices are best. Hence artificial incubation has come into extensive use, and as the most extensive application of these machines is in agricultural districts where the kerosene lamp is the standard of illumination, it is not surprising that this same lamp has come to be the standard source of heat.

About two years ago the writer witnessed the destruction by fire of the poultry houses connected with a large New York State institution, the origin of the fire being directly traceable to an incubator lamp, and it occurred to him that here was another legitimate field for electricity in the heating of incubators and brooders. Since that time experiments have been carried out, and with gratifying results.

As a beginning, an incubator said by the makers to be fitted to



REGULATING MECHANISM OF INCUBATOR.

operate by electricity was purchased from a well-known manufacturer, but it was evident from the first that it would prove unsuccessful. The principle upon which it operated was that an electric stove was arranged so as to heat water in an expansion tank, the water in turn heating the air inside the machine by circulating through pipes. The heat regulation, a very important detail in a machine of this class, was secured by cutting the stove in and out by means of a mercury switch operated directly from the thermostat through a system of levers, but owing to the sluggish action of the thermostat, a very destructive arc was formed each time the circuit was opened or closed, and the pin which dipped into the mercury would last only a few days.

In order to use this machine in the experiments several changes were made. The small mercury cup was discarded, and one of ample dimensions substituted, and as a means of preventing the arc, a very small solenoid was connected in series with the stove and just under the lever carrying the pin which plunged into the mercury. To this lever was attached the plunger of the solenoid, so that when the pin first touched the mercury the current flowing through the solenoid would throw the lever out of balance and plunge the pin deep into the mercury. On opening, the reverse would take place, the pin breaking the arc instantly. The objectionable feature of this mechanism is that with it close regulation is impossible, partly owing to the large body of water which continues to raise the temperature after the heat is shut off, and partly owing to the solenoid, which prevents opening and closing the circuit at the same temperature. However, this machine has run successfully for two seasons, and the variation in temperature does not exceed three degrees. This variation might be considerably reduced by using a thermostat to close a battery circuit through an automatic switch, which switch in turn closes the main circuit. This arrangement is successfully used in many bacteriological incubators.

After the chicks are hatched, they must be placed in a brooder, and here, too, the kerosene lamp may well give way to electricity. A brooder which we have constructed is heated by coils of iron wire beneath which is a plate of sheet iron. Strips of flannel hang from the sheet iron, and into this flannel the chicks run and huddle together. In another, the source of heat is from incandescent lamps enclosed in a sheet metal box, with strips of flannel as above suspended from the bottom. Both brooders are controlled by rheostats so that any temperature can be maintained at will. It was found that eight 24-cp lamps furnished sufficient heat for a brooder 6 ft. by 4 ft., but this number could be materially reduced by proper precautions in the way of heat insulation—nothing of the kind having been attempted in the above instance.

The objection may be raised that in agricultural districts the current cannot be obtained, but many of the large stock farms already have their lighting plants. The trolley roads could furnish current to many others; and in large poultry yards, where many thousand eggs are hatched each season, it would seem that the small plant necessary would be a profitable investment, especially since nearly all such yards are located in the vicinity of streams which could develop sufficient power for the purpose.

We are told that in Egypt artificial incubation has been carried on so long that the hens have long since ceased to show any inclination to incubate their own eggs. The dynamo may prove to be the emancipator of the sitting hen, as it has been for the street-car horse.

Storage Battery Auxiliaries—II.

BY LAMAR LYNDON.

COMPOUND BOOSTER.

The compound booster is used on railway and power circuits supplying widely fluctuating loads where the batteries serve to prevent excessive feeder drop, and assist the power station, relieving the generating machinery from the sudden heavy current rushes. Diagramatically, this system is shown in Fig. 3.

G is a generator, E a battery, B the booster armature, F a series field, f a shunt field, R a rheostat in shunt field circuit, M and M motors, and S a reversing switch by means of which the m. m. f. of the shunt field may be added to or subtracted from that of the series field. The operation of this system is as follows:

Under normal conditions the shunt field m. m. f. creates an e. m. f. in the same direction as the battery e. m. f. tending to discharge it. Calling Eo the generator e. m. f., V the booster e. m. f., and E the battery e. m. f., we have $Eo - V = E_A$ (8), when there is neither charging nor discharging current. In this case the generator current equals the external load current. If the load increases, Eo falls, and $E_A + V$ becomes greater than Eo, allowing the battery to begin discharging. The discharge current passing through the series coil produces an e. m. f. proportional thereto, and acting with the shunt coil, thereby increasing V and increasing $E_A + V$, causing a still more rapid discharge. The battery thus assisting the generator

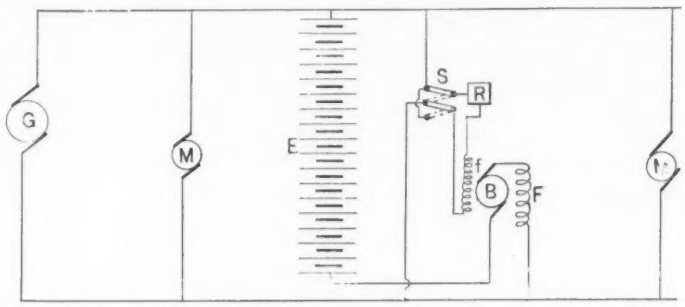


FIG. 3.—DIAGRAM OF SYSTEM.

causes the load on the latter to decrease and its voltage to rise again until it attains its normal e. m. f.

If the load on the external circuit falls below normal, Eo rises and current starts flowing into the battery. In this case, the series field m. m. f. opposes that of the shunt coil, decreasing V. Then $E_0 > E_A + V$ and the charging current increases until Eo begins to fall, and comes down to its normal value. These changes are, more strictly, tendencies to change which are checked in their inception.

In order to compute the size and windings of the booster and capacity of battery, a load curve is necessary. This in case of a new

plant may be made up from assumed data, which, with the amount of data available covering operating plants similar to the proposed plant, will usually be sufficiently accurate to use as a basis for computation.

The armature and series coil must have a current carrying capacity equal to the maximum battery discharge, or $I_0 - I_x$ in which

I_x = generator current.

I_0 = current of external load.

Also let

I_A = Normal external load, equal to average load.

E_M = maximum generator voltage.

E_A = battery voltage at any state of charge (voltage at no-load).

E_N = normal battery voltage.

h = constant which multiplied by the generator current equals drop in generator e. m. f.

R = internal resistance of battery.

k = volts generated in armature per ampere turn on field.

N = number of cells in series = $\frac{E_A}{2}$.

The series turns compensate for the drop due to resistance of the battery circuit. Therefore $T k I = R I$ and $T = \frac{R}{k}$ (9), I being the current flowing into or out of the battery. In this equation the characteristic of the booster is assumed to be a straight line. The factor k also assumes a constant permeability.

When $I_x = I_0$, current flows neither into nor out of the battery, and

$$E_M - I_x h - V = E_A \qquad (10)$$

Inasmuch as the booster causes the battery to act as if it had no internal resistance, the only factors that enter into the determination of I_x are V, E_A, E_M and h, or,

$$I_x = \frac{E_M - V - E_A}{h} \qquad (11)$$

These are all constants and, therefore, I_x is constant for any given value of E_A, whatever the load, provided the shunt coil is connected across the mains and gives a constant m. m. f.

If, however, the shunt coil is connected across the battery terminals, equation (11) becomes

$$I_x = \frac{E_M - \frac{V E_A}{E_N} + I_0 \frac{R V}{E_N} - E_A}{h + \frac{R V}{E_N}} \qquad (12)$$

This shows that the generator current varies with the load if f be connected across the battery. The factor $\frac{R V}{E_N}$ is, however, usually very small as compared with the other quantities.

If V be made small, E_A more nearly approaches $E_M - I_x h$, and the size of the machine is kept down. If V be made large the size of booster is increased, but the number of cells decreased.

Generally, V at normal voltage of battery should be small—5 to 10 volts. The shunt coil, however, must be capable of producing an e. m. f. high enough to maintain the equality of (10) when E_A is at its minimum, and also to preserve the equality of

$$E_M - I_x h + V = E_A \qquad (13)$$

when E_A is at its maximum and the field is reversed in direction, the booster adding its e. m. f. to the generator e. m. f. $E_{A\,max} = 1.15 \times E_A$, or V_{max} must equal $.15\ E_A - V$ when connected across the line and $\frac{.15\ E_A}{1.15} - V$ when connected across the battery V_{max} for $E_{A\,min} = 0.1 \times E + V$ for connection across the line, and $\frac{.1 \times E}{.9} + V$ for connection across the battery.

These data fix the shunt winding, and together with eq. (10), the size and resistance of the rheostat. This latter should be capable of varying the shunt coil e. m. f. from 3 volts to maximum by steps of not over 3 volts each.

The size of the motor is fixed by the maximum of voltage multiplied by the current, both being taken at the same instant. This product is a maximum when the battery is at its lowest voltage, and discharging its maximum current.

Assuming 1.8 volts per cell as a minimum, $E_{A\,min} = \frac{E_A \times 1.8}{2} = .9\ E_A$. The voltage then of booster when discharging $I_{max} = 0.1 \times E_A + (I_{max}\ T k) + V$. Watts $= I_{max}\ (0.1 \times E + I_{max}\ T k + V) =$ size of driving motor.

This form of booster can also be connected for normal operation with the shunt coil e. m. f. in opposition to the battery e. m. f., in which case

$$E_M - I_x h = E_A - V \qquad (14)$$

and the required number of cells in series is greater than when connected with V opposing the generator e. m. f.

The relations of the various quantities can easily be worked out from the equations given by making the proper substitution of signs. In this case

$$I_x = \frac{E_M + \frac{V E_A}{E_N} - I_0 \left(\frac{R V}{E_N}\right) - E_A}{h - \frac{R V}{E_N}} \qquad (15)$$

The equation shows that connected in this way the generator load varies inversely as the external load. This would put too great a load on the battery at the time of maximum discharge.

As a concrete example, illustrating the application of the foregoing analysis assume

E_M = 500 volts.

V = 10 volts.

h = 0.15.

I_x = 100 amperes normal.

I_0 = 400 amperes maximum.

R = .2 ohm.

k = .02 volt.

$E_A = 500 - (100 \times .15) - 10 = 475$ volts.

$T = \frac{.2}{.02} = 10$ turns.

$N = \frac{475}{2} = 238$ cells.

with any given values of E_A and V, I_x will remain unchanged whatever may be the variation of I_0.

If E_A varies and V be not varied to compensate therefor, I_x will vary, but will be independent of the external load.

When $E_A + V = E_M$, I_x reduces to zero and the battery carries the total external load.

When E_A is a minimum, I_x is greatest if V remains constant.

$$I_{x\,(maximum)} = \frac{500 - 10 - 427.5}{.15} = 416 \text{ amperes.}$$

Of course, this is an abnormal current that might occur under extraordinary conditions, but E_A could never fall to 427.5 volts without manipulation of the rheostat, which would leave the system in an approximately proper condition to make the battery take its share of the load.

The calculations for I_x when the shunt coil is connected across the battery, may be made by substituting in eq. (15). In the example assumed, $I_x = \frac{500 - 475 - 10}{.15 + \frac{.2 \times 10}{475}} = 97.4$ amperes, when $I_0 = 0$; with $I_0 = 100$, $I_x = 100$ amperes; and for $I_0 = 400$, $I_x = 108$ amperes. The regulation is better with the shunt coil connected to the line.

When E_A rises, and V is not reversed, the battery tends to take all the external load. Therefore, conditions may occur under which I_x will fall as low as 50 amperes, while $I_0 = 400$. The carrying capacity of the booster armature and series coil should be 350 amperes for, say, 10 minutes.

The maximum voltage that the shunt coil can produce is the greater of two maxima; the one when E_A is maximum, and the

shunt coil reversed acting to *prevent* discharge; the other when E_A is minimum.

$V_1\ max$ for $E_A\ max = 475 \times .15 - 10 = 61.25$ volts.

$V_2\ max$ for $E_A\ min = 0.1 \times 475 + 10 = 57.5$ volts.

The shunt coil, therefore, with all resistance cut out, must be capable of producing 62 volts.

The booster voltage is maximum when E_A is at its minimum and I_0 maximum, and is $(V_2\ max + I\ max\ T\ k)$, in which $I\ max = I_0\ max - I_x$. This is $57.5 + 2\ (400 - 100) = 117.5$ volts. The maximum booster and driving motor capacity is $117.5 \times 300 = 35.25$ kw.

As the maximum is seldom reached and then lasts only a few moments, about 70 per cent of the calculated capacity would be great enough, or 25 kilowatts in the above case. The motor horsepower is $\frac{25}{.746 \times .90} = 37.2$ hp, .90 being the efficiency assumed for the booster.

Fig. 3 shows that the load may come on the line either between the booster and the power station or between the booster and extreme end of the line. The battery and booster may therefore be located on a railway feeder at the point of greatest drop. The battery may also be made to help the power station on the peak of the load by manipulating the rheostat as E_A falls.

This system, depending as it does on the rise and fall of generator e. m. f. with corresponding change of load, requires that the generator be a shunt machine or its equivalent.

Where a plant has in operation a generating equipment of compound-wound dynamos, and this booster and battery system is applied, some change must be made in the generators. If the series field be entirely cut out, the dynamo will not generate the normal e. m. f. at normal load. In order to make use of the existing machines and windings, the arrangement shown in Fig. 4 is resorted to.

In this diagram G is the generator, f and F its shunt and series fields, respectively, E a low-voltage accumulator—usually one or two cells—and R a variable resistance in series with the series field circuit. The battery is connected in multiple with the series coil and resistance R, as shown. When the load on the generator is normal, the drop through $F + R$ is equal to the battery e. m. f. If the generator load rises $(F + R)$, Ix is greater than the battery e. m. f., and the current divides, part going through the battery and the normal current going through $F + R$. Should the load decrease and battery e. m. f. be greater than $(F + R)\ I_x$, the battery discharges and sends the normal current through $F + R$. The variation in Ix will be small, owing to the regulating effect of the main battery and booster on the line.

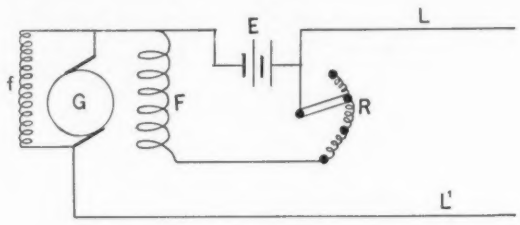


FIG. 4.—DIAGRAM OF CONNECTIONS.

Since, with this arrangement, the generator excitation is the sum of a constant excitation and an excitation that varies inversely as the load, its characteristic will be similar to that of a shunt machine.

The compound booster system together with the described arrangement of compound generator is covered by patent No. 625,099, issued on May 16, 1899, to J. B. Entz. This patent also covers the use of a series booster without shunt field, which is the same as H. Ward Leonard's patent, No. 435,700, of Sept. 2, 1890.

Since boosters usually carry heavy currents at low voltages, the commutator and brush surfaces necessary are often much larger than in the case of standard dynamos. In order to make use of standard commutator segments, to keep the length of the brush holders down to standard and keep the commutator speed within the limits of good practice, double commutators are sometimes used. These are placed, one on either side of the armature, and are connected in parallel.

From the foregoing description it will be seen that the compound booster is automatic within certain limits of battery charge. Any marked change of battery voltage will be followed by a corresponding change in generator current, unless the rheostat be manipulated to bring $Ea + V$ back to normal.

While the theoretical generator current variation is small for a given change of load, there is always a sudden, momentary, current rush from the generator on increase of load, the duration of which is equal to the time lag of magnetization of the booster field. Lights on a circuit with variable load will "wink" on sudden changes of load. In this respect the compound booster is not so satisfactory as the differential and constant-current boosters, as in these *all* generator current passes through the series fields, which, by reason of their self-induction, oppose and check any sudden current rush, giving the booster field time to change its magnetization to the proper degree.

Fig. 5 shows the switchboard connections of a compound booster and battery applied to a railway system. To avoid confusing the diagram, the connections to the voltmeter switch are not shown.

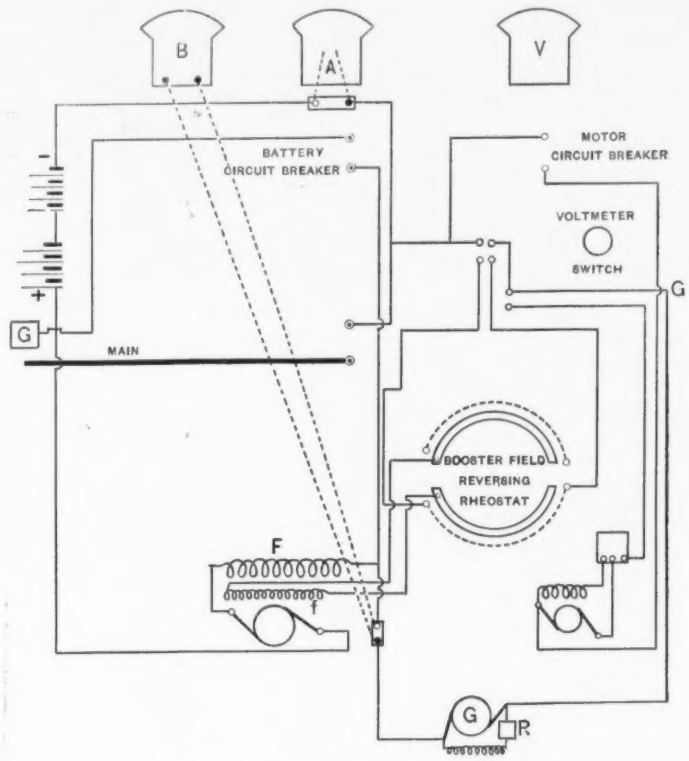


FIG. 5.—SWITCHBOARD CONNECTIONS.

These should be such as to show (a) battery voltage, (b) voltage of battery plus booster, (c) voltage of generator. A is a two-way reading ammeter in the battery circuit showing the charging or the discharging current. B is an ammeter in the generator circuit showing the current supplied to the system.

Hours of Daylight.

Some very interesting instruments are set up at various meteorological observatories that automatically register the periods during which the sun is unobscured by clouds during the daylight hours, and tables are printed giving the actual number of hours of sunlight during each year. By comparing the actual number of sunlight hours with the number of hours during which the sun is above the horizon at each place a percentage number is obtained, as in the following small table. In New York City, for instance, 64 per cent of the daylight hours, on the average, are sunny: St. Petersburg, 34 per cent; Hamburg, 28 per cent; Dublin, 33 per cent; Berlin, 39 per cent; Oxford, 30 per cent; London, 23 per cent; Ventnor, 37 per cent; Vienna, 38 per cent; Zurich, 42 per cent; Lugano, 56 per cent; Padua, 46 per cent; Rome, 55 per cent; New York, 64 per cent; Madrid, 45 per cent. The figures for New York are probably true on the average, as it is a very sunny city, but they certainly do not apply to last April and May.

Recent Additions to the Plant of the Niagara Falls Hydraulic and Manufacturing Company.

By Arthur B. Weeks.

THE Niagara Falls Hydraulic & Manufacturing Company, of Niagara Falls, N. Y., whose power house is located at the foot of the gorge of the Niagara, below the Falls, close to the water's edge, has recently installed a new penstock to supply 13,000 additional horse-power for manufacturing purposes.

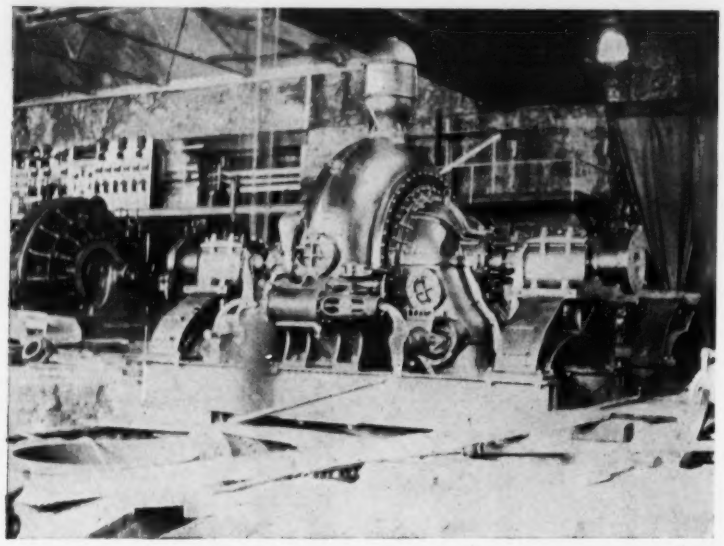


FIG. 1.—ONE OF THE TURBINES.

This penstock, which has been built, as was the one previously erected, by Suthers, Wells & Co., of Warren, Pa., has a diameter of 11 ft., and a head of 200 ft., and extends upward at a considerable distance from the almost perpendicular bank of the gorge. Upon the upper bank, and almost directly in line with this penstock, is a crane of great power, used for raising and lowering machinery to and from the power house.

FIG. 2.—BUILDING STONE ARCHES.

The new penstock will supply power for five turbines, one of which is shown in Fig. 1. The well-known firm of I. P. Morris & Co., was awarded the contract of supplying the turbines. The second valve has just arrived from Philadelphia. When these turbines with their dynamos have been fully installed, the third and last section of this power house will be completed.

FIG. 3.—THE ALUMINUM CONDUCTORS.

The next block of power for this company will, it is said, be supplied from a power house to be located below the present plant, toward the Whirlpool Rapids. This new installation will be for the use of the National Electrolytic Company, the Acker Process Company, the Pittsburg Reduction Company, and others.

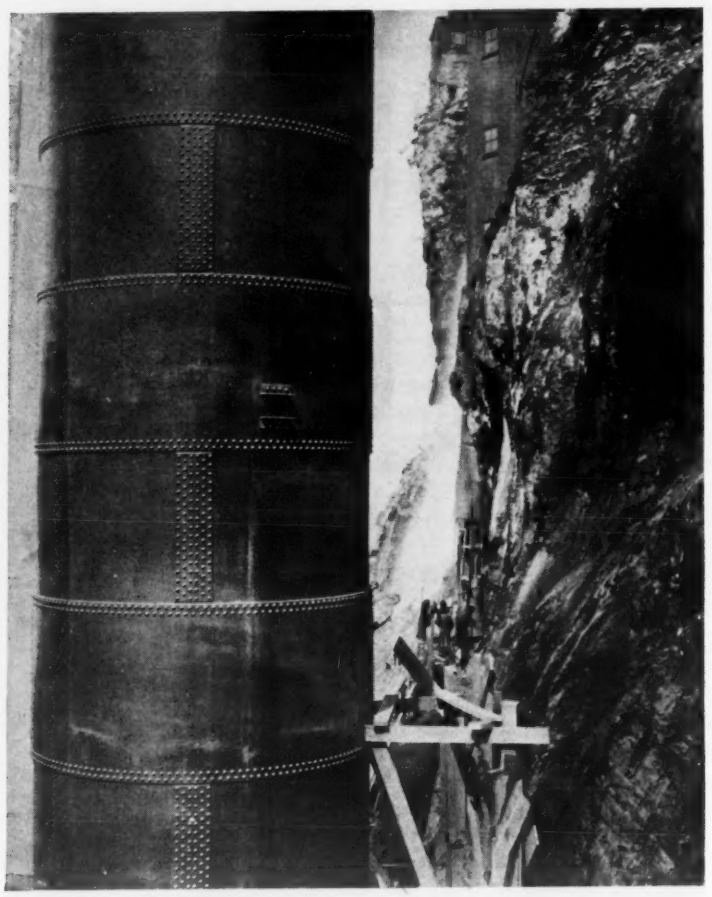


FIG. 4.—PORTION OF NEW PENSTOCK.

As can be partially seen in Fig. 2, men are now at work building stone arches in terraces with concrete, to continue upward to the overhanging bluff, and prevent the falling of great boulders from above, the disintegration of the rocky sides of the gorge being of frequent occurence.

Fig. 3 shows the manner of installing the aluminum bar conductors leading to the mills above. To the casual observer, short circuits might be expected frequently from the fact that bare conductors carrying thousands of electric horse-power, are carried fully 200 ft. up a steel penstock. It is scarcely needless to add, however, that such is not the case.

Fig. 4 shows a portion of the new penstock, and some idea of the nature of the rock formation may be gained from the beetling crags. Work is being pushed day and night to increase the capacity of the hydraulic canal in order that it may meet the increasing demands which will be made upon it.

Independent Telephone Exchange Statistics.

The following is a list of the larger independent companies in the various States. While not strictly up to date, it is probably the only list of the kind in existence, having been compiled by Judge Thomas, president of the Independent Association at the time of the annual meeting last year. It involved the expenditure of a great deal of time and money, which was not repeated this year. The figures for Ohio show towns having more than 300 subscribers, and the list was compiled early this year. In the other States towns having more than 150 subscribers are given:

Alabama.—Birmingham, 1100; Mobile, 565.

Arkansas.—Little Rock, 1500.

California.—Sacramento, 1300; San Francisco, 4000.

Delaware.—Wilmington, 1240.

Florida.—Jacksonville, 805.

Georgia.—Atlanta, 2270; Augusta, 515; Savannah, 620.

Illinois.—Bloomington, 700; Chadwick, 375; Champaign, 450; Charlestown, 240; Chrisman, 250; Danville, 518; Decatur, 810; Jackson, 600; Farmer, 200; Galena, 170; Galva, 165; Harrisburg, 160; Hartford, 173; Hoopeston, 194; Indianola, 280; Lincoln, 340; Mattoon, 470; Morrison, 306; Murphysboro, 210; Rantoul, 250; Rochelle, 400; Rushville, 162; Sandwich, 150; Sparta, 240; Sterling, 300; Sycamore, 318; Winchester, 139.

Indiana.—Ambia, 150; Anderson, 500; Auburn, 175; Bluffton, 820; Campbellsburg, 500; Clinton, 175; Columbus, 350; Connersville, 265; Crawfordsville, 636; Decatur, 200; Delphi, 213; Ft. Wayne, 2000; Green Castle, 220; Greenfield, 370; Hartford City, 300; Palacebrook, 200; Indianapolis, 3680; Jamestown, 200; Kentland, 160; Knightstown, 175; Le Grange, 200; Laporte, 325; Ligonier, 165; Linton, 150; Madison, 253; Michigan City, 504; Middletown, 165; Montpelier, 200; New Albany, 410; New Albany, 1272; Noblesville, 250; North Vernon, 264; Plymouth, 177; Richmond, 1200; Rockville, 160; Rushville, 230; Seymour, 172; Shelbyville, 520; Tipton, 245; Vanceburg, 200; Wabash, 330; Warsaw, 186; Williamsport, 200; Winchester, 220.

Indian Territory.—Chicasaw, 150; So. McAlestor, 250.

Iowa.—Belle Plains, 300; Boone, 475; Cedar Rapids, 875; Clinton, 500; Creston, 250; Decorah, 378; Des Moines, 1500; Dubuque, 2000; Fairfield, 231; Indianola, 180; Iowa City, 480; Iowa Falls, 375; Knoxville, 298; Marshalltown, 575; Nevada, 175; Adebolt, 150; Oskaloosa, 525; Ottumwa, 908; Seymour, 175; Spirit Lake, 600; Toledo, 180; Vinton, 195; Washington, 261; Waterloo, 180; Waterville, 200; Webster City, 300.

Kansas.—Atchison, 800; Beloit, 204; Chanute, 300; Clay Centre, 240; Council Grove, 200; El Dorado, 150; Ft. Scott, 317; Galena, 350; Hiawatha, 210; Holton, 210; Jewell City, 165; Leavenworth, 635; Lyons, 130; McPherson, 163; Manhattan, 321; Newton, 340; Ottawa, 460; Salina, 410.

Kentucky.—Ashland, 350; Bowling Green, 475; Carrollton, 200; Catletsburg, 165; Cynthiana, 205; Frankfort, 240; Fulton, 350; Henderson, 535; Mayfield, 370; Morganfield, 350; Owensboro, 450; Providence, 400; Somerset, 170; Winchester, 245.

Louisiana.—Alexandria, 200; Crowley, 200; Monroe, 200; New Iberia, 250.

Maryland.—Baltimore, 3000; Frederick City, 420; Salisbury, 210; Street, 250.

Massachusetts.—Boston, 400; Fall River, 700; Haverhill, 600; Shelburne Falls, 165.

Michigan.—Adrian, 550; Alma, 800; Albany, 266; Cassopolis, 147; Charlotte, 275; Concord, 150; Escanaba, 400; Fernville, 187; Grand Rapids, 3306; Greenville, 220; Hart, 400; Hastings, 280; Green Mountain, 406; Lansing, 775; Muskegon, 661; Owosso, 384; Saginaw, 2533.

Minnesota.—Albert Lea, 175; Alexandria, 160; Brainard, 190; Chatfield, 300; Crookston, 175; Duluth, 1278; Fairmont, 211; Fergus Falls, 275; Mankato, 440; Minneapolis and St. Paul, 5000; Winona, 625.

Mississippi.—Columbus, 317; Meridian, 415.

Missouri.—Bethany, 225; Boonville, 300; Brookfield, 485; Cameron, 250; Cape Girardeau, 310; Granville, 350; Chillicothe, 360; Columbia, 550; Fayette, 525; Glasgow, 175; Harrisville, 150; Jackson, 150; Liberty, 193; Louisiana, 300; Macon, 460; Marceline, 184; Marshall, 344; Moberly, 250; Shelbina, 300; Slater, 214; St. Louis, 7000; Unionville, 250; Webb City, 235.

Montana.—Billings, 150.

Nebraska.—Alliance, 190; Chadron, 191; Fairbury, 255; Lexington, 235; Nebraska City, 300; Plattsmouth, 400.

New Hampshire.—Laconia, 750.

New Jersey.—Bridgetown, 195; Mount Holly, 200; Newton, 200; Paterson, 1000; Vineland, 182.

New Mexico.—E. Las Vegas, 200.

New York.—Belmont, 150; Brockport, 152; Geneva, 185; Glenn. 159; Gowanda, 280; Greenville, 200; Massena, 182; Niagara Falls, 200; Norwich, 220; Oswego, 245; Rochester, 2000; Silver Creek, 200; Tonawanda, 200; Walton, 175; Watertown, 400.

North Carolina.—Ashland, 800; Charlotte, 415; Durham, 1800; Gastonia, 200; Greensboro, 200; Washington, 665; Wilson, 160.

North Dakota.—Valley City, 221.

Oklahoma.—Blackville, 250; Kingsfisher, 168; Perry, 235.

Ohio.—This list was taken Jan. 1, 1901, or about six months later than those from other States. It is especially interesting as showing the relative strength of the Central Union (Bell) companies and the independent companies. It shows, as has been previously intimated, that Ohio is the stronghold of the independent movement. In nearly every center in the State where the independent people have exchanges in operation, they are stronger than the competition. The single exception to this rule is in Cleveland, which has the largest independent exchange in the country. The figures from Ohio were furnished by local telephone officials in the respective places mentioned. The independent people add, "If there is any doubt about the correctness of this list, our 'friend the enemy' is entirely at liberty to point it out." Ashland County, 722; Akron, 1505; Ashtabula County, 1527; Barberton, 364; Cuyahoga Falls, 288; Bellefontaine, 360; Bryan, 384; Bucyrus, 575; Chillicothe, 700; Cleveland, 7500; Conneaut, 585; Coshocton, 535; Columbus, 5100; Columbiana County, 1784; Delaware, 495; Defiance, 485; Elyria, 780; Fostoria, 480; Fremont, 457; Gallipolis, 350; Ironton, 505; Kent, 400; Kenton, 430; Knox County, 815; London, 582; Lima, 620; Lorain, 600; Lancaster, 369; Massillon, 620; Marietta, 750; Painesville, 480; Portsmouth, 680; Sandusky, 900; Steubenville, 460; Tuscarawas County, 1900; Tiffin, 815; Urbana, 815; Youngstown, 1257; Washington C. H., 622.

Oregon.—Portland, 1100; Dallas, 417.

Pennsylvania.—Ashland, 200; Bellefonte, 675; Cambridge Springs, 210; Chambersburg, 860; Columbus, 414; Cooperburg, 290; Hanover, 300; Hazleton, 440; Indiana, 375; Kittaning, 300; Lebanon, 325; Lewisburg, 300; Nazareth, 300; Norristown, 600; Phœnixville, 162; Pittsburg and Allegheny, 5000; Pottsville, 350; Somerset, 350; Stroudsburg, 250; Summerfield, 500; Winchester, 200; Wilkesbarre, 1270.

South Carolina.—Charleston, 900; Chester, 172; Laurens, 145; Newport, 160; Sumter, 200.

South Dakota.—Deadwood, 500; Canton, 154.

Tennessee.—Bristol, 390; Columbus, 500; Huntington, 150; Martin, 185; Memphis, 1600; Sparta, 300; Abiline, 175; Brownwood, 170.

Texas.—Austin, 1200; Palestine, 300; San Angelo, 179.

Vermont.—St. Albans, 260.

Virginia.—Charlottesville, 510; Hampton, 255; Lexington, 220; Lynchburg, 608; Newport News, 510; Norfolk, 1500; Petersburg, 560; Roanoke, 1025; Stanton, 550; Winchester, 490.

West Virginia.—Bluefield, 275; Clarkesbury, 350; Logan, 500; Fairmount, 550; Grafton, 260; Hinton, 272; Huntington, 535; Parkersburg, 640; Roncevert, 300; Wheeling, 1000.

Wisconsin.—Beloit, 400; Ellsworth, 200; Grand Rapids, 260; Hicksston, 205; Zanesville, 651; La Crosse, 756; Mauston, 180; Martell,

300; Monroe, 240; Millsville, 150; Portage, 300; Richland Center, 400; Sheboygan, 550; Sparta, 155; St. Croix Falls, 150; Viroqua, 180; Wausau, 400; Wayauwega, 1000; West Superior, 550

The Boston Elevated Railway.

THE first cars for passenger transportation will be run over the Boston Elevated Railway during the present week. Work on this great undertaking has recently progressed very rapidly, and the road is opened to the public ahead of the time that had been fixed. The last girder of the structure was erected on April 12,

FIG. 1.—CHARLESTOWN TERMINAL.

and for the past three months motormen and trainmen for the system have been under instruction in a school where the men are taught the complicated details of the block signal system as well as the general management of the cars.

The total length of the elevated road is about 7½ miles. There will be about 20 stations on the system, which have been so designed as to be ornaments to both the railway and the streets. The terminal stations are large structures handsomely fitted up for their purposes. They are three stories high. The upper story will contain the offices chiefly. At the Charlestown terminal the elevated trains enter the second story and surface cars the lower floor, which is at the street level. At the Roxbury terminal the surface cars are elevated and form into a loop on either side of the terminal station, so that the passengers pass from one system to another on the same level.

The cars are 40 ft. long, and have sliding doors midway in the sides for the entrance and exit of passengers. The seats run lengthwise, and will accommodate 50 or 60 people. The motorman, from the vestibule, will control the entire train, which will be operated on the Sprague multiple unit system. The average rate of speed will be 16 miles an hour over rails weighing 85 lbs. to the yard. One hundred cars will be used at first, and the number increased with increase of traffic. It is intended that at least two trains shall arrive at and depart from each station every seven minutes.

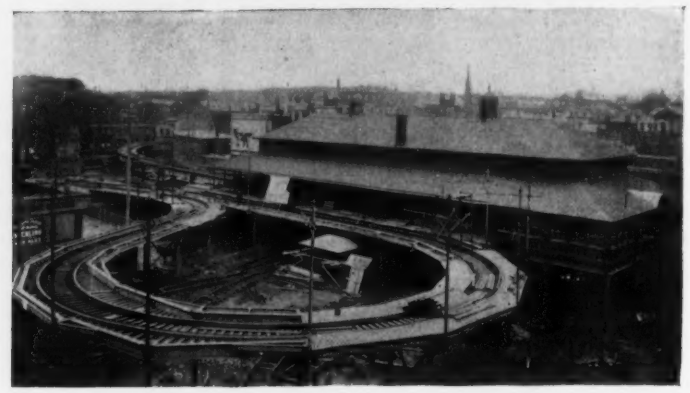


FIG. 3.—ROXBURY TERMINAL.

The system may be said to comprise three sections—a loop for

FIG. 2.—STATION AT WASHINGTON AND NORTHAMPTON STREETS.

the part of the system in the heart of the city, a branch through Charlestown, and a branch from the opposite side of the loop at Castle Street to Roxbury. The main or city section or loop is partly elevated and partly through the Subway, somewhat less than half of the length of the loop being underground. This section serves as a loop for both the Roxbury and Charlestown extensions. One class of trains goes direct from Charlestown to Roxbury, and vice versa, passing over one side of the loop.

The total cost of the system was $10,000,000, $1,200,000 being represented by the Charlestown line.

Handling New York Baggage and Express by Electricity.

According to President Sanderson, of the New York Electric Vehicle Transportation Company, by virtue of contracts entered into with his company, the Metropolitan Street Railway and the Union Railway can be made available for the long-haul baggage, express and package-delivery business in Manhattan, the Bronx and Westchester. On behalf of the transportation company this statement has been issued:

The New York Electric Vehicle Transportation Company has been trying for a long time to acquire the business of the Metropolitan Express Company. The express company has a contract with the Metropolitan Street Railway Company similar to the contract which has been in operation over the Brooklyn roads for some years.

The Transportation company pays $500,000 to acquire the Metropolitan Express Company and the Century Express Company, payment being made in bonds on the express company's property, with two years' coupons cut off, the bonds being guaranteed by the transportation company; interest, therefore, not beginning for two years.

By that time the business should become very profitable, as the earnings of the company by 1903 should much more than pay the interest on these $500,000 bonds, and the express company then become a large and growing branch of the transportation company's business. The acquirement of this additional business has, therefore, practically cost the transportation company nothing.

The Transportation company pays $500,000 to acquire the Metro-

the city, and these will be considerably increased in number, and the facilities for caring for one branch of the business will also very largely cover the other.

Much of the work, especially the delivery of goods from the railroads, will be done at night. The delivery of baggage and of goods sold by stores, which are expected to furnish a large share of the business of the new enterprise, must, of course, be done in the daytime, but the company plans to use only the lines east and west of Broadway, and to avoid the "rush hours." Twelve of the new baggage cars are now almost completed, and the company expects to run the first one on Tuesday. George W. Slingerland, who was formerly connected with the United States Express Company, will be general manager of the express department of the transportation company. The idea appears to be to wipe out gradually the old horse service of the express companies acquired and to substitute automobiles, which will distribute the baggage and express from the main points to which it is carried by the trolley cars of the system. It is believed that the service in Greater New York will be wonderfully expedited and cheapened.

Localization of Sound By the Ear.

In the University of Chicago has recently been carried out an interesting investigation on the capacity for auditory localization in the case of a man totally deaf in one ear. The subject of the experiment lost the sense of hearing in one ear in early childhood as a result of scarlet fever, and tests show him to be nerve-dead in that ear. In normal persons sound-localization supposably depends upon differences in the stimuli reaching the two ears. These differences can be due only to the quality or intensity of the sounds reaching the ear. For example, a sound opposite the right ear is localized in that direction because it stimulates the right ear more than it does the left, and also because, if it be a complex sound, its constituent overtones will be more noticeable in the right ear than in the left, so that it will be distinguished as qualitatively different from the same sound when heard in front, and hence given a different point of origin. In monaural hearing, if this be true, it is, of course, evident that any change in intensity in the sound can afford but ambiguous information as to its place of localization. With qualitative peculiarities of sound, however, it is different. In order to test this commonly received hypothesis the subject of the experiment was placed in the center of a large clock-dial placed horizontally, and the subject attempted to localize the sound by reference to the figures on the encircling dial, his eyes being closed during the conduct of the experiment. The sound stimuli used came from three sources, a tuning-fork, a Galton's whistle, and the snapping sound made by sending an electric current through a telephone. The experiment was provided with a mechanism by means of which the localization of the sound could be exactly registered as though on the surface of an imaginary sphere. The mechanism permitted all the adjustments to be made noiselessly.

The results of the experiments showed that the sound of the tuning-fork, which was a pure tone, practically devoid of overtones, was unlocalizable by the subject, while, on the other hand, the sounds of the Galton's whistle and the snapping-spark, which are filled with overtones, were localized with great accuracy. The degree of accuracy with which the sound was localized seemed to vary quite proportionately with the complexity of the sound. The results of the experiment, therefore, are comformable to the current hypothesis that the power of localizing sound depends on the detection by the nearer ear of differences in quality which the farther ear does not perceive.

Underground Electric Traction in London.

At a special meeting in London on June 7 the stockholders of the Metropolitan District Railway sanctioned Charles T. Yerkes' plan for the introduction of electricity as the motive power of the road. This is the old underground system. The agreement of the railway with Mr. Yerkes provided for the formation of an electric traction company to operate the road. Mr. Yerkes, represented 16 of the most influential firms, bankers and capitalists. The syndicate has bought already shares to the value of £1,250,000, and is ready to buy as many more. It has to construct a generating station at Chelsea, make the necessary alterations in the permanent way, and construct new rolling stock. It was stated at the meeting that the traction company undertook to convert the line without interfering wih a single train. Half a million of ordinary stock paid to the traction company was taken at the nominal price of £25, and £166,000 was taken in 4 per cent debentures at par. Five per cent interest was to be paid to the Americans on the outlay. A syndicate of bankers had undertaken to put up £1,000,000 as security for carrying out the contract.

It is stated from Baltimore that the Maryland Trust Company will be the American financial agent of the enterprise. Colonel J. Wilcox Brown, president of the Maryland Trust Company, spent three months in London in the past year examining the property and its possibilities. He had the assistance of J. G. White & Co., who made a thorough examination of the Metropolitan Railway and submitted an exhaustive report. The Metropolitan District Electric Traction Company, which is organized under the plan, will equip the Metropolitan District Railway Company and control it. The old line serves directly 1,000,000 people along its own tracks. This service will be increased fully 50 per cent, and the average train speed will be 25 per cent faster than at present. Trains with a maximum speed of 25 miles an hour are contemplated.

The Metropolitan has liberal franchises, which permit expansion to meet any requirements in the growth of its business. It is proposed to spend over £300,000 on new rolling stock and nearly £400,000 on a great power station. Other expenditures will increase the outlay to over £1,000,000. It is proposed to buy most of the plant in England.

Robert W. Perks, M. P., solicitor for the company, during the course of the meeting urged the importance of hastening the plans of Mr. Yerkes, giving as a reason that an American millionaire was interested in a project to construct an entirely new electric road from the city to Piccadilly.

Paris Transportation.

The Metropolitan Underground Electric road has carried 36,500,935 passengers since it started, just about a year ago, or nearly the whole population of France.

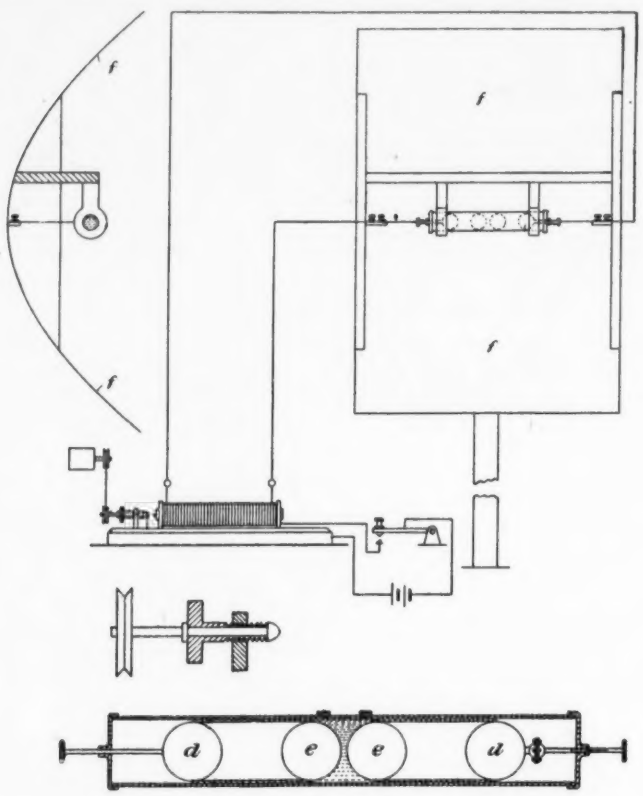
Marconi System of Wireless Telegraphy.

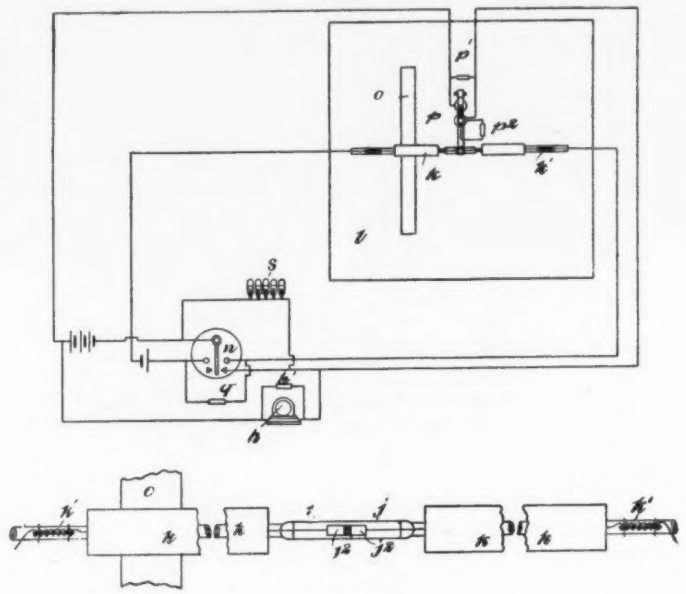
A patent issued June 4 to Guglielmo Marconi on an application dated July 13, 1897, describes in quite full detail the Marconi system of wireless telegraphy, including the methods employed for tuning the circuits and for selective telegraphy.

In the accompanying illustrations, Fig. 1 is a diagrammatic front elevation of the instruments at the transmitting station, and Fig. 2 a front elevation of the instruments at the receiving station. Below Fig. 1 is a longitudinal section of the oscillator to a larger scale, and a detail of the trembler interrupter. Below Fig. 2 is an enlarged view of the receiver.

In Fig. 1 *f* is a cylindrical parabolic reflector, shown also to the left of the figure. In Fig. 2 is a reflector similar to that used at the transmitting station. The reflectors ought to be in length and opening at least double the length of the wave emitted from the oscillator. It is slightly advantageous for the focal distance of the reflector at the receiving station to be equal to one-fourth or three-fourths of the wave length of the oscillation transmitted.

Below Fig. 1 is shown the transmitter sparking arrangement. The Ruhmkorff coil is connected to the metallic balls *d*, which are





FIGS. 1 AND 2.—MARCONI WIRELESS TELEGRAPHY.

fixed by heat or otherwise at the ends of the two tubes shown. These tubes fit tightly into a similar tube having end covers through which pass the terminal rods. One or both of these rods is connected to the ball *d* by a ball-and-socket joint, and has a screw head upon it working in a nut in the cover. By turning the rod, therefore, the distance between the balls *e* may be adjusted. On top are holes through which an insulating oil or like material is introduced into the spaces between the balls *e*. With a coil giving an 8-inch spark the distance between *e* and *e* should be from 1-25 to 1-30 of an inch, and the distance between *d* and *e* about 1½ inches. The balls are usually of solid brass of 4 inches diameter, giving oscillations of 10 inches length of wave.

Above the sparking arrangement is shown a detail of the trembler break. This consists of a revoluble central core in an ordinary screw, which is in communication with platinum contacts. The central core is caused to revolve by connecting it to a small electric motor, as shown. By this arrangement the platinums are kept smooth, and any tendency to stick is removed.

The coherer is shown enlarged on the right, and consists of a glass tube containing metallic powder, each end of the column of powder being connected to a metallic plate *k* of suitable length to cause the system to resonate electrically in unison with the electrical oscillations transmitted. For the powder nickel is the best metal, and about 10 per cent of hard silver filings are added to the nickel filings, thus increasing greatly the sensitiveness of the tube to electric oscillations. By increasing the proportion of silver powder or grains the sensitiveness of the tube also increases; but it is better for ordinary work not to have a tube of too great sensitiveness, as it might be influenced by atmospheric or other electricity. The sensitiveness can also be increased by amalgamating with mercury the inner surface of the plugs which are in contact with the filings, just sufficient mercury being used to brighten the surface of the plugs without showing any free globules. Following are the dimensions of the coherer:

The tube *j* is 1½ inches long and 1-10 or 1-12 of an inch in internal diameter. The length of the stops j^2 is about 1-5 of an inch, and the distance between the stops is about ⅓ of an inch. The smaller the spaces between the stops in the tube the more sensitive it proves, but the spaces cannot, under ordinary circumstances, be excessively shortened without injuring the fidelity of transmission. The metallic powders ought not to be fine, but as coarse as can be produced by a large and rough file. All the very fine powder ought to be removed by blowing or sifting. The powder ought not to be compressed between the stops, but left in a loose condition. The tube must be sealed; a vacuum inside is not essential, but is desirable. Usually a vacuum of about 1-1000 of an atmosphere is used. It is necessary for the powder or grains to be dry and free from grease or dirt, and the file in producing the same ought to be frequently washed and dried, and used when warm. If the tube has been well made it should be sensitive to the induction from an ordinary electric bell, when the same is working at one or two yards or more from the tube.

It is desirable that not more than 1 milliampere of current shall flow through the coherer. If a stronger current is necessary, several tubes may be put in parallel between the tuned plates, but this arrangement is not quite as satisfactory as a single tube. It is necessary when using tubes of the type described not to insert in the circuit more than one cell of the Lelanche type, as a higher e. m. f. than 1.5 is apt to pass a current through the tube even when no oscillations are transmitted.

The plates *k* are of copper or aluminum or other metal, about ½ inch or more broad, about 1-5 of an inch thick, and preferable of such length as to be electrically tuned with the oscillations transmitted.

The means adopted for fixing the length of the plates is as follows: A rectangular strip of tinfoil about 20 inches long is stuck by means of a weak solution of gum on a glass, then by means of a very sharp penknife the tinfoil is cut through the middle. If this detector is some four or five yards away and parallel with the axis of the oscillator, in action it will show little sparks at the end. If the length of the pieces of tinfoil approximates to the length of the wave emitted from the oscillator, the spark will take place between them at a certain distance from the transmitter, which is maximum when they are of a suitable length. By shortening or lengthening the strips,

therefore, it is easy to find the length most appropriate to the length of the wave emitted by the oscillator. It is desirable to place this detector in the focal line of the reflector. The length thus found should be made about ½ inch shorter on account of the length of the coherer connected between them.

The two plates communicate with the local circuit through two very small choking coils *k*, formed by winding a few inches of very thin and insulated copper wire about a bit of iron wire 1½ inches long. The object of these choking coils is to prevent the high frequency oscillations induced across these plates by the transmitter, from dissipating itself by running along the local battery wires, which might weaken its effect on the coherer. The choking coils may sometimes be replaced by simple thin wires, and may also be connected directly to the coherer. The piece *o* at right angles to the coherer is a support for the rod to which the coherer is secured.

The local circuit in which the coherer is inserted contains a sensitive relay *n*, preferably wound to a resistance of about 1200 ohms; or this resistance may be the sum of that of the relay and an additional resistance, the relay to be one possessing small self-induction.

In Fig. 2 *p* is a trembler for tapping the coherer tube, which must be carefully adjusted. Preferably the blows should be directed slightly upward. A platinoid resistance *p'* is shunted across the trembler, having about five times the resistance of the latter. In shunt with the relay is a series of liquid resistances, *s*, consisting of tubes filled with acidulated water. Their number should be about 10 for a circuit of 15 volts. They prevent, by their counter e. m. f., the current of the local battery from passing through them, but allow the high-tension jerk of current at the opening of the circuit in the relay to pass smoothly across without producing perturbing sparks at the movable contact of the relay. It is also necessary to place a platinoid resistance in shunt on any apparatus one may be working with on the local circuits. *h'* is such a resistance around the telegraphic receiver *h* of about 10 times the resistance of the coils of the latter. Similarly, *q'* a resistance of about four times that of the relay with which it is in shunt. Such a resistance p^2 is also inserted across the contacts of the relay.

CURRENT NEWS AND NOTES.

ACETYLENE.—The splendid acetylene building at the Pan-American Exposition will be formally dedicated during the convention of the International Acetylene Association at Buffalo, June 20-22. The building contains a complete acetylene exhibit.

NEWFOUNDLAND TELEGRAPHS.—Mr. Reid, the Newfoundland contractor and capitalist, has consented to surrender the telegraphs to the Government and to revise his land grants, so that the rights of other holders will be protected. He will undertake to allow the colony to purchase back from him the ownership of the railway at the end of 50 years by compensating him for the value of the property at that time.

NEW PACIFIC CABLE.—The State Department is in receipt of information concerning work on the British Pacific cable, which is to connect the Dominion of Canada with the Australian confederation. The new cable is to be 5834½ miles in length, the longest ever constructed, and will be transported and laid by one ship, which is now being built for that purpose. The cable will run from Vancouver Island to Fanning Island, which lies south of Hawaii, a distance of 3337 miles, before landing is effected; thence it will be laid to the Fijis, to Norfolk Island and then to Queensland.

TELEPHONES IN RAILWAY SERVICE.—It is stated that the Missouri Pacific Railway Company intends to put in a system of telephones along its lines to connect a station that does not jutsify the employment of an agent with the nearest station that does. A telephone station will be established at the siding and the key to the box will be left with the nearest family. Then when a farmer wants a car set in at the siding or wants to send a message, he can go to the telephone, call up the agent at the next town and transact his business over the wire, instead of being compelled to drive to the next town for that purpose.

TELEPHONY IN BERLIN.—An observant European correspondent writes us: "One afternoon about a fortnight ago, a shower came down in Berlin, and although there was not the slightest indication of lightning or thunder, the whole telephone service of Berlin was suspended for several hours. It was the most ridiculous piece of officialism that I ever heard of. It seems that the minute a drop of rain falls they shut up the telephone exchanges and all hands go out for beer. They don't do it anywhere except under the administration of the Reichspost, there being no such nonsense in Bavaria or Wurtemburg."

RAPID GROWTH OF SHAWINIGAN FALLS.—The electric town of Shawinigan Falls, Que., which had a population of one dozen people two years ago, is now a municipality of 4000 people, all owing to the generation of electric energy there. The town is laid out precisely like the city of New York, bounded on two sides by a river. So far, the chief industries are the Shawinigan Water & Power Company, having at present a capacity of 25,000 horse-power, with capabilities of developing 100,000 horse-power; the Pittsburg Reduction Company, the great pulp factory being constructed by the Belgo Pulp & Paper Company, the Calcium Carbide works, large brick works and a cotton mill about to be constructed. All these industries are the outcome of electric power development.

ELECTRICAL DEVELOPMENT IN CANADA.—Negotiations are under way for the construction of a line of electric railway up the Lievre River, Que. There is abundant French capital behind the scheme. What is proposed is to construct a line of electric railway from Buckingham, 100 miles up the river, to Rapide L'Orignal, the numerous falls on the route affording ample power for the generation of the necessary electrical energy, not only for the railway, but for phosphate mining purposes, which it is intended to carry on in the Buckingham district. Mr. Ulric Rouville, a Parisian capitalist, who owns about 40 acres of these mining lands, is the promotor of the railway, and has laid the plans of his project before the Dominion Government for the purpose of obtaining a subsidy.

SCIENTIFIC RESEARCH.—An Institution for Scientific Research, to be located at Washington, was incorporated May 20. Fifteen prominent educators and scientists have been chosen as trustees, and the officers are President Gilman, of Johns Hopkins University; C. D. Walcott, director of the Geological Survey; Dr. Nicholas M. Butler, of Columbia College, and C. J. Bell, of the Washington Security & Trust Company, are the officers of the institution. The movement originated in the Washington Academy of Sciences, which, in co-operation with the George Washington Memorial Association, has formulated a plan which has been approved by both organizations. The Memorial Association undertakes to secure a suitable site and erect thereon a building sacred to the memory of George Washington, and the Academy of Sciences undertakes to provide for the maintenance and conduct of the institution in the interest of science and literature. There may be joined with it in this work the National Educational Association, the Association of American Universities and the Association of Agricultural Colleges and Experiment Stations. Congress passed an act last March to enable the plan to be carried out, and the new institution was incorporated on May 20. Fifteen prominent educators and scientists have been chosen as trustees.

NAMES OVER THE TELEPHONE.—The following from the New York *Times* as to the difficulty of getting names over the telephone shows how indistinctly most people speak: William Arrowsmith, of the law firm of Joralemon & Arrowsmith, was chatting about men who change their names the other day. "I don't blame some men for going into the courts and getting their names changed since the telephone came into general use," he said. "When a name is nearly all composed of consonants, the owner has good reason for wanting it changed if he is in business and has to tell his name over the 'phone several times a day. Take my own name, a good old English family name. One would hardly think that over the telephone it would be wildly distorted, but it is often done. I have spelled it out slowly, only to hear the answer come back, 'All right, Mr. Irishsmith.' Again, I will get it as plain 'Smith,' and once the man at the other end of the wire replied 'Ironsmith,' and then, in an aside to some friend, 'Wonder he doesn't make it "Blacksmith"!' The latest telephonic interpretation came the other day when a package plainly addressed 'Mr. Eherenschmidt' came to my house. I don't propose to change my name, but if men with 'skys' and other peculiar attachments to their names have as much trouble in proportion as I have, I don't blame them for changing."

THE NORTHWESTERN ELECTRICAL ASSOCIATION.—The summer convention of the Northwestern Electrical Association will be held at Sheboygan, Wis., on June 26, 27 and 28.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—At the commencement exercises of the Massachusetts Institute of Technology President Pritchett made the announcement that the corporation had authorized the immediate erection of a laboratory of applied electricity of the most modern sort, to cost, with equipment, $275,000. It is stated that the new laboratory, when completed, will be the finest of its character of any institute of learning in the world.

ELECTRICAL CONTRACTORS.—The proposed national convention of electrical contractors at Buffalo on July 17 begins to loom up as a large affair. Information can be obtained from the secretary, Mr. W. H. Morton, 31 Catharine Street, Utica, N. Y., as to the meeting itself, and data as to hotel accommodations, etc., can be obtained from Mr. H. I. Sackett, president of the Buffalo Contractors' Association, Builders' Exchange, that city.

BECQUEREL RAYS.—M. Henri Becquerel is reported to have had an odd personal experience with the form of radiation which bears his name. He started out on a journey with a piece of radium in a small cardboard box in his waistcoat pocket. Some time after his journey, M. Becquerel found a mark on his body under the location of the pocket, and further experiment showed that radium rays affects the skin through cardboard and cloth, but that about a fortnight elapses between the contact of the rays with the skin and the appearance of burn marks. It was also found that these burns are much more difficult to cure than ordinary burns.

THE WISCONSIN VALLEY PLAN.—Several telephone companies are doing business in several cities under what is known as the "Wisconsin valley plan." The corporation can sell stock only to such persons as rent its services, and the renter can buy as many shares of stock as he rents telephones, and no more. Whenever the stockholder ceases to rent as many instruments as he holds shares, the company reserves the right to call in and cancel his excess of stock and refund to him its par value. The company bonds itself so to regulate its capital stock that every renter of its service may purchase stock if he so desires. The company must also regulate its monthly charges so as to be able to pay its stockholders a dividend of 1 per cent a month, to be credited to each stockholder on his monthly rental.

LAUNCHING A TUNNEL.—On Saturday a steel tunnel, 250 ft. long, 25 ft. in diameter, and weighing 1200 tons, was launched at a shipyard in Elizabeth, N. J. It was constructed to serve as an intake for the condensing plant of the Thirty-ninth Street and East River generating station of the Edison Illuminating Company, now nearing completion. It is constructed of an exterior and an interior shell of quarter-inch thick riveted steel. Between the two shells is 15 inches of concrete, all of which was in place when the structure was launched. The tunnel will be towed to the new station on the East River, where it will rest on a foundation of piles and riprap built 23 ft. under water. The tunnel will be set to firmly rest on the foundation, and this part of the work all completed in about three weeks. The cost of the tunnel was $75,000.

THE CONVENTION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—The twentieth annual meeting of the Association of Railway Telegraph Superintendents will be held at Buffalo on June 19, 20 and 21. The list of papers to be read and discussed includes the following: "Importance in Telegraphy of Apparently Little Things," by Mr. T. D. Lockwood; "Rapid Telegraphy," by Mr. Walter P. Phillips; "Storage Batteries," by W. E. Athearn; "Cipher Code for Railroading Telegraphing," by C. H. Rhoads; "Railroading by Telephone," by F. P. Valentine; "Construction of Telegraph Relays from a Scientific Standpoint," by Professor C. E. Freeman, of the Armour Institute; "Line Construction," by C. H. Bristol, and "Crossing Alarms," by U. J. Fry. A paper on "Automatic Telephone Exchanges," by Mr. William Maver, Jr., is also promised.

ELECTROPLATED LACE.—The idea that lace or other fabric might be electroplated so as to present a surface of metal while retaining its pattern and, in part at least, its flexibility, dates from the times of James Napier and Schattlaender, the earliest days of practical galvanoplasty. The difficulty lies in the preliminary "metallization" of the fabric, the entire surface of which must be rendered conductive to serve as a basis for the electro-deposit. A patent issued June 4 to Mr. James Hart Robertson, of Brooklyn, and assigned to the Metal Fabric Company, of New York, covers the following method for accomplishing this: The fabric is first dipped in a potassium cyanide solution of silver chloride containing a dissolved binding agent, as gum-shellac, then at once transferred to a solution of silver nitrate. Silver separates regularly over the surface of the fabric, which may then be connected as cathode and electroplated as usual, first with copper, then, if desired, with a precious metal.

ENGINEERING EDUCATION.—The Society for the Promotion of Engineering Education will hold its ninth annual meeting at Buffalo on June 29, July 1 and 2, 1901. The programme includes no less than 22 papers and discussions. Among the topics included are "Cultural Value of Engineering Education," by Professor F. O. Marvin; "Arrangement of Undergraduate Courses in Electrical Engineering," by Professor J. P. Jackson; "The Availability of Correspondence Schools as Trade Schools," by Prof. D. C. Jackson: "The Danger of Excessive Specialization in Undergraduate Engineering Courses," by Professor J. C. Nagle; "Present Tendencies in Technical and Industrial Education," by Professor J. B. Johnson. A discussion on "Graduation Requirements for the Bachelor Degree in Engineering" will be opened by Professors W. G. Raymond, Robert Fletcher and L. S. Randolph. Papers will be read by Professor C. Frank Allen and Mr. William Kent on "The Extent to which Engineering Teachers Should Engage in Outside Work." A paper by Professor Aldrich will be on "Research and Publication Among Engineering Teachers."

CANADIAN ELECTRICAL SOCIETY.—Following is a list of the papers to be read at the next annual meeting of the Canadian Electrical Society, which will be held in Ottawa on June 19, 20 and 21: "Transformation from Constant Potential Alternating to Constant-Current Alternating," by Professor R. B. Owens; "Notes on Construction and Protection of Aerial Transmission Lines," by K. B. Thornton; "Dominion Electrical Standards," by O. Higman; "Rates for Electric Light," by H. L. Doherty; "The Influence of the Load Factor on the Design and Operation of a Lighting and Power System," by J. R. Robertson. Discussions will be held on the following topics: "The Best Practice in Cleaning, Trimming and Inspection of Enclosed Arc Lamps," and "The Different Systems of Charging for and Measuring Power Consumed by Induction Motors with Varying Power Factors." An interesting social programme has been arranged by the committee, and on the evening of June 20 the annual association banquet will be held at the Russell House. Visits will be made to the power houses at Chaudiere Falls, Deschenes Rapids and other places of electrical interest.

ELECTROLYTIC ALKALI AND CHLORINE.—An electrolytic cell designed for the production of chlorine and caustic soda from brine forms the subject of a patent recently issued (June 4) to Alfred Merry, of Liscard, and John H. Noble, of Liverpool, England. The anode is contained within a tightly closed porous cup, which in turn is closely wrapped by a cathode of wire gauge, and the whole is immersed in water, a disposition adopted in the prior devices of Drake and Mercer. The novelty lies in the use, within the porous cup, of a supplemental porous sleeve, perforated at its lower portion and surrounding the anode, the inlet and outlet pipes for the brine being so arranged as to permit a rapid upward flow to be maintained between the sleeve and the anode whereby the chlorine bubbles are entrained with the electrolyte. At the same time a considerable head of electrolyte is used, so that the porous vessel is at all times completely filled, and the solution is forced slowly through its walls, insuring that no layer of diffused caustic alkali shall form around the sides of the cell, and by carrying a portion of the current, reduce its efficiency. The inventors state that by this disposition there is gained much more of the theoretic power of the electricity than has hitherto been considered possible. Practical experience, however, has always shown a diaphragm, especially in a cell intended for the electrolysis of sodium chloride, to be costly, inefficient, wasteful of energy, and subject to rapid deterioration, and the proposition to avoid anode polarization by interposing two such elements between the electrodes will hardly meet with favor.

A NERNST LAMP HEATER.—A patent issued June 4 to J. Van Vleck and W. N. Stevens describes a removable heating arrangement for a Nernst lamp. The heater is within a plug, and when this is entered in the glower lamp the heater circuit is closed automatically. Ordinarily the electric heating device is removed from the lamp, and is inserted only when it is desired to set the lamp in operation.

PARIS EXPOSITION REPORT.—The Government Paris Exposition Report will make six octavo volumes averaging about 600 pages to the volume. It will contain more than 300 half-tone illustrations printed on heavy enameled paper, and about 50 maps and plans of the United States' exhibition, areas and installations. As Congress did not provide copies for general public distribution, Mr. A. S. Capehart, late of the U. S. Exposition Committee, ordered a number from the Government Printing Office, which he has had bound in library style. Sets of the same may be obtained from Mr. Capehart (P. O. Box 445, Washington, D. C.), at a cost of $20.

A NEW PRIMARY BATTERY.—A patent granted June 4 to C. T. Sittig, of Gross-Lichterfelde, Germany, describes a primary battery which is designed to combine the advantages of both a dry and a liquid cell. The exterior of the cell resembles that of the ordinary dry cell, the case being of zinc with the top of the cell sealed in. The carbon electrode is centrally disposed within the case, being surrounded by a suitable depolarizing substance such as maganese dioxide, which is retained within a sack surrounding the carbon. Between this electrode and the side of the case is a liquid chamber to which there is an inlet extending through the outer lid, and sealed by a removable screw cap. Through this inlet the liquid chamber may be emptied and filled with a new electrolyte. On a partition near the top of the cell is a layer of loosely packed material such as rice chaff, above which is the asphaltum seal, through which extends two small glass tubes adapted to take off the gases forming in the liquid chamber.

PILOT SWITCHBOARDS.—A patent granted June 4 to L. B. Stillwell relates to the details of pilot switchboards, whereby switching devices may be operated from a distance, and the position of each of such devices indicated to the attendant at the pilot board. The pilot switchboard is a miniature representation of the main switching circuits, having devices which represent the main switching devices, and controlling connections to the main operating means whereby the main devices are controlled by the pilot devices, and indications given of the movements and positions of the main devices. When one of the main switchboard's devices changes its position and connections, either automatically or otherwise, the corresponding pilot switchboard devices are similarly changed in position and apparent connections. The pilot switchboard is so arranged in combination with diagrammatic bus-bars and connections as to convey to the eye an accurate representation of the connections existing in the main switchboard, and give at all times a diagrammatic representation of the main devices and their circuit connections.

ANOTHER CANADIAN POWER ENTERPRISE.—Our Canadian correspondent says that a big project is well advanced towards a starting point for the purpose of supplying the city of Montreal with pure water, cheaper power and light, and an immense cold storage plant. The concern is to be capitalized at $5,000,000. This gigantic enterprise, he says, has already reached a stage where its successful accomplishment is assured. Several New York capitalists are interested in the scheme, and, in fact, are the backbone of the undertaking of which Mr. James E. Wilder, of Montreal, is a prominent promoter. Speaking upon the subject, Mr. Wilder said: "The water power at the Lachine Rapids, between the Hydraulic Company's plant and the Isle Heron, the island itself and a portion of the Panniston farm, have been secured by our company. The power generated by compressed air process will be about 50,000 horse-power, or nearly three times that of the Lachine Hydraulic Company. We have completed arrangements with the Taylor Hydraulic Air Compressing Company, whereby we will use its system. It is the intention of our company to install an immense electric and compressed air plant, part of the compressed air to be utilized in purifying the water and to elevate it on the spot to a height above the present reservoir, which will enable us to supply the whole island of Montreal, and to transmit electric power and compressed air power through the city. The compressed air will supplant steam, and will be used for general power. The exhaust will be used for cold storage. We shall commence work within three months, and it will be pushed vigorously until it is completed. We hope to have everything in readiness for operation in two years."

BRITISH INSTITUTION OF ELECTRICAL ENGINEERS.—The British Institution of Electrical Engineers will make an excursion to Germany this month, leaving London, June 22. The party will be divided into three sections, Group A visiting Berlin only; Group B visiting Berlin and Dresden, and Group C visiting Berlin, Dresden, Nuremberg, Frankfort, etc. The programme in Berlin includes visits to the electricity supply stations of Berlin and to the works of Siemens & Halske and the Allgemeine Elektricitaets Gesellschaft. A visit will also be paid to the Wannsee Electric Railway and the experimental high-speed electric railway near Berlin. Messrs. Siemens & Halske and the Allgemeine Elektricitaets Gesellschaft on Monday evening, June 24, will give a reception and supper to the Institution, and on Wednesday evening a dinner. Other visits in Berlin will be to the new elevated electric railway, the telephone exchange and to the technical high school, where Dr. Slaby will meet the members. On Friday morning, June 28, a visit will be paid to the tool works of the Niles Tool Company, in Berlin, by such members as shall remain over. On Thursday evening Group B will proceed to Dresden, where a reception that evening will be given by the German Electrical Technical Society. On Friday and Saturday mornings meetings of the German Electro-Technical Society will be attended, and in the afternoons visits will be paid to various electrical installations in Dresden and vicinity. At Nuremberg, Group C will visit the works of Messrs. Schuckert & Co., and at Frankfort the Lahmeyer works. An evening reception will be given by Messrs. Schuckert in Nuremberg, and by the local Electro-Technical Society in Frankfort. Visits will be paid to the Wiesbaden and Hamburg central stations and to the Elberfeld-Barmen Mono-rail Electric Railway.

LETTER TO THE EDITORS.

Electro-Chemistry.

To the Editors of Electrical World and Engineer:

Sirs.—Referring to the editorial on Electro-Chemistry in your issue of April 27 and to the discussion which has followed, you will perhaps allow a German electro-chemist to add his opinion concerning education in electro-chemistry.

The marvelous development of the electro-chemical industry in this country cannot fail to impress in the highest degree any one when he compares it with the relatively slow progress of practical electro-chemistry abroad. This condition having been reached without modern theories of electro-chemistry having been taught in American technical schools to any considerable extent, the conclusion seems to follow, that there may be no utility at all in these theories. Mr. Burgess, in his letter of May 18, appears to maintain this standpoint, with exemplifications from several highly developed branches of the industry.

But his conclusion, I would say, seems to be rather uncertain. Any invention of a new process or any improvement of an old one is a fact which can be considered and more or less explained with reference to every theory, for the existing electro-chemical industry is an application as well of modern as of old science. But the question is, whether in the brain of the inventor modern theory did not promote the association of ideas finally leading to the result attained. To this question the final technical result cannot give an answer. For that, one has to possess knowledge of the mental processes of the inventor, and if found that modern theory furnished one link in the chain of his thoughts or facilitated his foreseeing difficulties or calculating results, then theory cannot have been useless.

As another proof of the failure of theories, Mr. Burgess points out that in Germany, where most electro-chemical theories have been developed, electro-chemical practice has not made more rapid progress than in this country. But generally practical progress is not made in the study or laboratory where theoretical work is done, and until recently, even in Germany, there were not many electro-chemical engineers sufficiently familiar with the new developments of their science to give any superiority in that respect over the engineers of other countries. At present, in Germany the education of electro-chemists is based on the new ideas.

But from one standpoint the instruction of electro-chemists is still

an unsolved problem abroad. At the last year's meeting of the "Deutsche Electrochemische Gesellschaft," Professor Lorenz, of Zurich, read a paper on "Education of Electro-Chemists," prepared at the special request of the association, which was followed by an interesting discussion. The gist of the opinions offered was that, theoretically speaking, an electro-chemist is a man who ought to have complete knowledge of chemistry as well as of electrical engineering; but as time and the capacity of students are limited, the instruction practically cannot be more than a compromise with respect to these two branches, the extent in either direction depending upon the teacher's individual opinion as to whether electro-chemistry is to be considered rather as a department of chemistry than of electricity.

KONRAD NORDEN.

NEW YORK, N. Y.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS

Induction Motors.—EBORALL.—His fourth lecture on polyphase working, dealing mainly with the construction of induction motors. He first considered the relative advantages of holes and slots in the stator stampings of induction motors. Hole disks are excellent mechanically, but are hard to wind, and they may be troublesome on account of the magnetic leakage over the bridge piece. The latter effect necessitates that the radial depth of this bridge should be diminished as much as possible, and that means that the core has to be machined, instead of the stamping being employed just as they are, as in the case of slotted armatures. As the chief disadvantages of the slot are the difficulty of stamping and its greater magnetic resistance, the balance of the advantage is, in his opinion, in favor of this form. Rotors, on the other hand, are usually hole-wound. He is of the opinion that the permanently short-circuited squirrel cage rotor should be abandoned for a polyphase winding that admits of slip-rings and the insertion of resistances on all motors above 5 horse-power. He emphasized the importance of reducing the magnetic leakage. For this reason many slots per pole per phase must be used in the stator, and this is also necessary to avoid a tendency to synchronism. He gave the following data as a guide in the design of induction motors: Clearance (iron to iron) the 450th part of the diameter of the rotor; flux densities in air-gap, 30,000 lines per square inch, in stator teeth, 60,000, and in rotor teeth, 80,000; current density in rotor wires, 1100 to 1500 amperes per square inch; peripheral speed, 6000 ft. per second; "ampere wires per foot" in stator, 300 for sizes up to 5 horse-power, and 450 up to 100 horse-power. Owing to the small clearance, an essential point is that the case be a stiff mechanical job, this being a particular weakness in polyphase traction motors. The efficiency of polyphase motors is said to be a shade lower than direct-current motors up to 100 horse-power, but their weights are about the same. He pointed out the importance of having the full-rated pressure applied at the motor terminals, the torque being proportional to the square of the voltage. He dealt also briefly with the systems of transmission. He condemned two-phase systems in general, and spoke in favor of three-phase. A point to be observed in the design of the three-core cables for three-phase transmission is that experience in continental Europe has shown that the distance between the conductors and the sheath should be quite as great as that between the conductors themselves.—Lond. *Elec.*, May 24; *Lightning*, May 23.

Speed Regulation of Shunt-Wound Motors.—STOCK.—A brief article, illustrated by diagrams, on speed regulation within wide limits, of shunt-wound motors driving machines in paper plants, dyeing plants, etc., where a speed variation of 30 to 1 or even 60 to 1 is sometimes required. The motor has a rheostat in the circuit of the shunt field, and is supplied with current from a special dynamo which is excited by a small compound-wound dynamo having a rheostat in the shunt field. If two motors are required in the shop which have to work independently, he uses two primary dynamos, excited by the same compound-wound exciter. There is a rheostat in each of the fields of each primary dynamo.—*Elek. Anz.*, May 9.

REFERENCES.

Resistance of Short-Circuit Armatures.—HEUBACH.—An article of a theoretical nature, in which he calculates by simple mathematics the resistance of a short-circuited armature. He gives a simple approximate formula for the apparent resistance of a bar of a short-circuit armature, which gives results good enough in practice. Regarding the best dimensions of a short-circuit armature, he shows how to make this apparent resistance a minimum for a given quantity of copper. He finally shows briefly how to calculate by an analogous method, the value of the stray fields of an induction motor, if the exciting forces and fields have a sinusoidal form.—*Elek. Zeit.*, May 23.

Induction Motors.—E. H.—The first part of an illustrated summary of the present construction of single-phase and polyphase induction motors. He first gives diagrams showing the relation between couple and speed and rotor resistance. He then gives a general outline of the typical construction of the stator and rotor, with illustrations.—*L'Ind. Elec.*, April 25.

LIGHTS AND LIGHTING.

Cooper-Hewitt Lamp.—A general discussion of this lamp and in general of "electric vapor lamps." While it has been commonly considered that a rarefied gas is an exceedingly bad conductor, J. J. Thomson has shown that this apparent resistance is mainly due to the difficulty which the discharge has in passing from the electrodes into the gas, and that if the circuit is made to consist entirely of the rarefied gas, the gas is seen to be a remarkably good conductor of electricity. It is asked whether Cooper-Hewitt has succeeded in making a lamp in which nitrogen is used, as in this case the very high resistance between electrode and gas must be absent. It is said to be possible that the incandescence in the Cooper-Hewitt mercury vapor lamp may prove to be due to a large extent to actual metallic conduction by the mercury vapor along the sides of the tube. The objection to the lamp in its present form is not on the ground of want of efficiency, but the nature of its light. If no other vapor than mercury vapor can be found to give good results, then it is feared that the lamp will not prove suitable for commercial use, as the color of the light makes it impracticable, the spectrum of mercury having practically no red lines. Attention is called to an English patent of the General Electric Co., of this country, for commercial electric lamps in which the light is produced by a mercury are with various substances added to the vapor to give any desired color to the light. It is suggested to improve the Cooper-Hewitt lamp in this direction.—Lond. *Elec. Rev.*, May 24.

Powell.—An illustrated article on the same lamp, in which he describes an observation made in the course of an automatic distillation of mercury in vacuo; when in a spiral in his apparatus sufficient mercury globules had collected to cause a drop to flow and collect other globules in its path, he observed a brilliant streak of greenish light along the track of the rolling mercury. He believes that perhaps "by the rolling of the mercury static electricity is developed which, in the presence of the surrounding heated mercury vapor, gives rise to momentary Geissler tube effects."—Lond. *Elec. Rev.*, May 24.

REFERENCE.

Blue Printing by Electric Light.—Some further particulars on the method of the Gen. Elec. Co., taken from an Am. Soc. Mech. Eng. paper of Reist.—*Eng. News*, May 30.

POWER.

Polyphase Motors for Hoisting.—A brief article on the use of polyphase motors for the operation of mining hoists. While polyphase motors are inherently so constituted that they work to their best advantage when at full and unvarying speed, and at practically unvarying loads, these conditions are the very antipodes of those existing in mine hoists, where the speed, the amount of and variation in load, vary to the widest possible degree. "Nevertheless, the trying conditions imposed are being slowly but surely overcome, and it is believed by many of high repute that the period is not far distant

when the application of polyphase motors to every variety of mine hoist will be an accomplished success. The operation of hoists by direct-current apparatus is in as high a state of perfection as is the electric street railway system.—*Jour. of Elec.*, April.

REFERENCES.

Electricity in Manufacturing Works.—ALDRICH.—An abstract of a paper read before the Am. Soc. of Mech. Eng. He gives some general considerations based on electric power in manufacturing plants, and discusses its sanitary advantages, its disciplinary value, the flexibility of the system, and the reliability of service. He considers the economies of electric power, the first cost and the cost of maintenance of electric systems; the influence of electric transmission upon factory buildings, workshop expansion, and the arrangement of machinery. He discusses the relative advantages of individual driving and group driving, the factors determining the selection of the electric equipment, and the efficiency of the electric system.—*Eng. News*, May 30.

Mechanical Applications of Electricity.—RICHARD.—A summary of recent improvements in electric telepherage and elevators.—*L'Eclairage Elec.*, April 20.

Three-Phase Traction.—VON KANDO.—An article on high-tension three-phase traction on interurban lines. After some introductory remarks on direct and alternating-current traction in general, he discusses the advantages due to the use of a high tension, the dangers of high-tension currents, and the rational limit of the tension. He recommends making the tension in the primary as high as possible. The tension in the trolley wire is limited by the following considerations: The cross-section of the conductor decreases with the increase of tension, but should not be smaller than required for giving the necessary mechanical strength. The distance between the transformer sub-stations should not be made too great. A transformer easily stands very large momentary overloads. The distance between sub-stations should be small enough so that the variation in the load is within the limits required by the transformers. He does not favor the system which has been suggested to place the transformers on the locomotives, as this method sacrifices one of the greatest advantages of electric traction, namely, the small dead weight of the motor cars.—*L'Eclairage Elec.*, May 11.

Alternating Direct-Current Converter Stations for Traction.—HOBART.—An article on the "Choice of type and periodicity for electric traction plant." His conclusion is that "for future traction projects, the rotary converter should be superseded by the motor-generator, and the periodicity should be still further lowered for the case of very slow speed steam engines; but it may often still be advantageous to employ rotary converters, and at 25 cycles per second, for plants where the generators are direct connected to high-speed engines."—Lond. *Elec. Rev.*, May 24.

REFERENCES.

Submarine Boat.—WEBER.—An article on the electric equipment of a submarine torpedo boat, with which experiments have been made some time ago by the German Government. It has a battery of 250 cells, with a capacity of 720 ampere-hours if discharged in 12 hours.—*Centralblatt. f. Accum.*, May 15.

Isle of Thanet.—An illustrated description of this new British light railway. The length of the line is 11 miles. The direct-current trolley system is used with high-tension three-phase current transmission, and a converter sub-station.—Lond. *Elec. Rev.*, May 24.

Automobile Exhibition.—An illustrated article on the recent motor car exhibition held at the Agricultural Hall, Islington. The number of motor cars exhibited was near 300, but electric automobiles were greatly in the minority. A review of the electric exhibits is given.—Lond. *Elec. Rev.*, May 17.

Batteries for Automobiles.—FAY.—An article on the rate of discharge of batteries in electric vehicle work. He says that "the battery would be a great success if, in the course of events, the rate of discharge were reduced to that which would discharge the battery in five hours, instead of the present three-hour basis." This is shown by a table giving the battery performance at a three-hour and a five-hour discharge.—*West Elec.*, May 25.

Automobile Construction.—CLEMENT.—A second paper giving notes on automobile construction. He discusses the power losses in the transmission mechanism, the road resistance, the effect of the diameter of the wheels, the road resistance, the resistances due to gravity, and the air resistance. Several tables are given.—*The Rose Tech.*, May.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Storage Batteries in Electric Power Stations.—HIGHFIELD.—An editorial on his recent Brit. Inst. Elec. Eng. paper. "He rejects the regulating cell system, and now regulates by the variable pressure booster, so designed that by varying the field, the pressure can be varied from 0 to a maximum either way. He uses a double-wound armature in one field, each half of the battery being in series with one of the armature windings, and the field is varied by a 30-point rheostat, and a reversing switch so interlocked with it as to vary the volts given by each armature from 0 to 50, each point serving to vary through two volts. The battery center is connected to the neutral bus-bar of a three-wire system, and a good type of balancer is employed. One-half of the battery may be charged by disconnecting the other half entirely from the bus-bars and charging through the balancer." The battery serves as a controller for station pressure, as a store to allow the generators to be run at constant output, and as a general reserve. It is also useful in that it will burn out a line fault that might damage a generator. He estimates the cost of the plant, exclusive of buildings, at $125 to $250 per kw. Allowing $175 as a usual figure, he finds that at a three-hour rate of discharge a battery costs as much per kilowatt as the mechanical plant. "At a one-hour rate the cost per kilowatt is less, and in a lighting plant" he would put in a battery one-sixth to one-fourth the maximum station output, which will carry the peak of the load for three hours. A traction load may usually be run with a battery of one-hour discharge capacity, and its cost will be $75 to $90 per kilowatt. He considers the ideal system for traction to be generation at constant load, i. e., the economical engine load for, say, 16 hours a day. The battery is to take charge of all peaks and absorb its charge when the inverse peaks occur, and it is to take all the load when this is small, as when cars are shedding or turning out. The cost of a battery is said to be about 7 per cent annually for "replating." A battery may, it is stated, have an "efficiency" as high as 84 per cent.—Lond. *Elec. Rev.*, May 17.

Sherbrooke.—An illustrated article on the electric plant of Sherbrooke province of Quebec, Canada. The present capacity is 840 kilowatts. Water power is used to generate two-phase currents of 133 periods at 2400 volts. The current is used mainly for lighting, but there are also installed 23 two-phase motors ranging from 1 to 30-kw capacity and aggregating a total of 240 horse-power.—*Can. Elec. News*, May.

Cham.—An illustrated article on the electric plant of Cham, a small town in Germany. The three-wire direct-current system is used with 300 volts between the outers for lighting and 600 volts between the outers for power purposes. For street lighting 15 arc lamps and 75 incandescent lamps of 32 candle-power are used. In private houses are connected 1600 lamps of 16 candle-power and 3 arc lamps and 20 horse-power of motors.—*Elec. Anz.*, May 19.

REFERENCES.

British Central Station Statistics.—The large annual table of direct-current electricity works in the United Kingdom. There are 117 provincial and 16 London stations. A large amount of information is given in 25 columns; there is no summary.—Lond. *Elec. Rev.*, May 10.

Storage Batteries in Central Stations.—LUNN.—A paper read before the Detroit Eng'ing Soc'y on the installation, operation and economy of storage batteries in central stations, with a description of the battery plant of the Edison Illuminating Co., of Detroit, Mich.—*Jour. Ass. Eng. Soc.*, April.

Chicago.—An illustrated article on the alternating-current lighting system recently installed by the Ill. Central Railroad Co., for its central and suburban stations in Chicago.—*West. Elec.*, May 25.

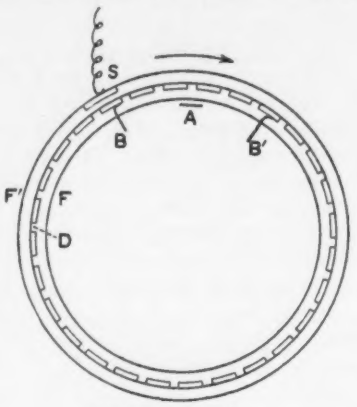
San Mateo County.—PENNOYER.—An illustrated description, with map, of the electric power transmission and distribution system of the Consolidated Light & Power Co., in San Mateo County, Calif.—*Jour. of Elec.*, April.

Rheostat.—HUTTON.—A brief description of a simple rheostat used for a special purpose to absorb 750 kilowatts of three-phase current at 11,200 volts.—*Jour. of Elec.*, April.

ELECTRO-PHYSICS AND MAGNETISM.

"Open Currents."—CRÉMIEU.—A continuation of his very interesting researches. In former investigations he had endeavored to show that electric convection produces no magnetic field. It follows that "open currents" must exist, and he demonstrates their existence as

follows. On an ebonite disk D, 37 cm. in diameter and 2.5 mm. thick, segments are "gilt," as shown in the adjoining figure. The disk turns about a central axis between two fixed ebonite disks F and F'. The disk F' bears a tinfoil armature S, twice as broad as the moving armatures. Two brushes B B', 60 degs. apart, are in contact with the moving armatures. When S is charged, the armature in contact with B acquires an induced charge, which passes on to B' where it is discharged. If B and B' are connected there will be electric convection between them on the one hand and electric conduction on the other. At A is placed one needle of an astatic system. If B and B' are joined through a galvanometer, the latter shows a deflection, while A does not.



OPEN CURRENTS.

If B and B' are joined through a coil placed near the lower needle of the astatic pair, a deflection of A is observed as soon as S is charged, and varying with the sign of the discharge. The current circulating in B B' B is therefore an open current.—*Comptes Rendus,* May 6; abstracted in Lond. *Elec.,* May 24.

Nitrogen and Tesla Currents.—KAUFFMANN and HELL.—An account of an experiment in which nitrogen was exposed to the influence of Tesla currents. The nitrogen is contained in a wide glass tube, in which there is a narrow tube filled with mercury connected to one pole of a Tesla coil, while the other pole is connected to an external tin coating on the wider glass tube. On working the Tesla coil, a blue fluted light appears in the wide tube, accompanied by a green fluorescence of the glass walls. The green fluorescence appears to be generated wherever the blue rays impinge upon the glass, just as if these were cathode rays.—*Phys. Zeit.,* May 11; abstracted in Lond. *Elec.,* May 24.

Hysteresis in a Revolving Field.—DINA.—An account of an experimental comparison of the energy dissipated per cycle in a field revolving at a speed of 1200 r. p. m. with that in a field varying successively in steps, the magnetic induction being studied in the latter case by the ballistic method. The hysteresis in the revolving field is greater than the other hysteresis until about a maximum induction of 10,000 and then becomes smaller gradually. At a maximum induction of 18,100 the difference is 9 per cent.—*Rendiconti del R. Ist. Lomb.,* v 33, 1900; abstracted in *L'Eclairage Elec.,* April 20.

Longitudinal Thermo-Magnetic Effect.—LOWNDS.—An experimental investigation on the effect discovered by Ettinghausen and Nernst, that if in a circuit, consisting partly of bismuth and partly of other metals, the latter be traversed by a current of heat in a certain direction and also be immersed in a magnetic field whose lines of force are at right angles to the heat current, then the e. m. f. of the circuit depends upon the strength of the magnetic field. The present author finds that, when one junction is kept at a temperature of —120 degs., the effect attains a maximum at a field intensity of 2450 units, and then decreases with increasing field, probably becoming negative at a certain strength. This is remarkable in the face of Gamagurchi's result that the transverse thermo-magnetic effect continues to increase with the field, even at the lowest temperatures attained. Both the longitudinal effect and the change of resistance may be represented by the same formula, except at low temperatures, where the longitudinal effect changes sign.—*Ann. der Physik,* No. 4; abstracted in Lond. *Elec.,* May 24.

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Induction in an Open Circuit.—KOENIGSBERGER.—An account of some experiments made to demonstrate, if possible, the existence of the displacement current induced in a circuit consisting partly or wholly of dielectric material when either the conducting or the non-conducting part of it is placed in a varying magnetic field. He has not yet made a decisive experiment.—*Phys. Zeit.,* May 11; abstracted in Lond. *Elec.,* May 2, May 24.

Photographic Alternating-Current Curves.—WEINHOLD.—An illustrated article on the use of Braun's cathode tube for demonstrating and photographing alternating-current curves.—*Elek. Zeit.,* May 16.

Condenser Discharge.—MIZUNO.—A mathematical paper on the influence of a non-inductive resistance on the oscillatory discharge of a condenser in a circuit having resistance and inductance. The non-induction resistance is connected in parallel to this circuit.—Lond. *Elec.,* May 24.

Hysteresis of Sheet Iron.—STERN.—An account of a large number of measurements of the coefficient of hysteresis in a piece of sheet iron at different parts of the sheet.—*Elek. Zeit.,* May 23.

ELECTRO-CHEMISTRY AND BATTERIES.

Measuring the Velocities of Ions.—ABEGG.—A German electrochemical society paper, in which he gives an account of a new and very interesting method of Steele for measuring the transport numbers (relative velocities) of the ions in aqueous solutions. The method is based upon the following phenomenon: When in a vertical tube two different aqueous solutions of about equivalent concentration with one common ion, for instance, Li Cl and KCl, are placed one above the other, and a current flows through them from the Li Cl to the KCl, then the conductivity of the Li Cl is smaller than that of KCl, as the speed of migration of Li is smaller than that of K, at the same time the drop of potential per unit length is greater in Li Cl than in KCl; it is then observed that the boundary surface between Li Cl and KCl is kept well defined, but travels in the direction of the current. The speed at which it travels is the speed of the last K ions, and the first Li ions. The boundary surface is kept well defined, because whenever a K ion diffuses into the Li Cl solution it is automatically driven back by the higher voltage drop which exists there, and as the K ion has a higher speed than the Li ions, the latter cannot follow it quickly enough. On the other hand, when a Li ion diffuses into the KCl solution, it comes into a region of smaller voltage drop and, on account of its lower speed, it cannot keep pace with the quicker K ions and therefore drops back into the Li Cl solution. His method, based upon this phenomenon, is as follows: If he wants to measure the relative velocities of K and Cl, he uses a cell in which the following three electrolytes are placed, one next to the other. Li Cl, KCl, KAc, it will be seen that the first two solutions have the Cl ion common, the latter two the K ion; the acetate ion has a slower speed of migration than the Cl ion. The Li Cl and the KAc solutions are in gelatine preparation, while the KCl is a simple aqueous solution. If a current is then sent from Li Cl to KCl, the positive Li and K ions travel in the direction of the current, while the negative Cl and Ac ions travel in the opposite direction. The boundary surface Li K travels in the direction of the current with a certain speed which is measured. The boundary surface Cl, Ac travels in the opposite direction with another speed, which is also measured. He shows that the ratio of these two speeds represents the ratio of the migration velocities of K and Cl, so that the transport numbers may easily be calculated. The boundary surface between two electrolytes is well defined by the difference of the optical density, so that its position can be measured exactly. The arrangement of the apparatus is described. From the results of some tests given it appears that the method yields quite exact results.—*Zeit. f. Elektrochemie,* May 16.

Increasing the Capacity of the Lead Accumulator by Heating.—An illustrated note on a patent of Heim, who suggests heating the lead accumulator, in order to diminish the viscosity of the sulphuric acid and to quicken the diffusion. From this then results a large increase of the capacity, and tests have shown that this increase amounts to 3 per cent per centigrade degree, which would double the capacity for an increase of the temperature by 35 degs. An arrangement is described and illustrated for heating an automobile battery.—*L'Eclairage Elec.,* May 11.

New Method of Closing Portable Storage Battery Cases.—SIEG.—A description of a new device of the Hagen Accumulator Works, of Cologne. They provide the ebonite covers of their storage battery cases with a soft-rubber border, which is firmly connected with the cover during the vulcanization. The soft rubber border is cut off in such a way that the lower part of the cover fits exactly into the opening of the case and the upper part presses firmly against the walls of the case. The cover has a small hole to permit the escaping of the gases. The arrangement is said to have proved very practical. It is said that exactly an hour is needed to clean an automobile battery of 42 cells, including the time for connecting and disconnecting all screws.—*Centralblatt f. Accum.,* May 15.

UNITS, MEASUREMENTS AND INSTRUMENTS.

German Standards.—A specification of electrical standards, issued by the German Government. The ampere is the current depositing 0.001118 grain of silver per second from an aqueous solution of silver nitrate, prepared in the following way: It is to contain 20 to 40

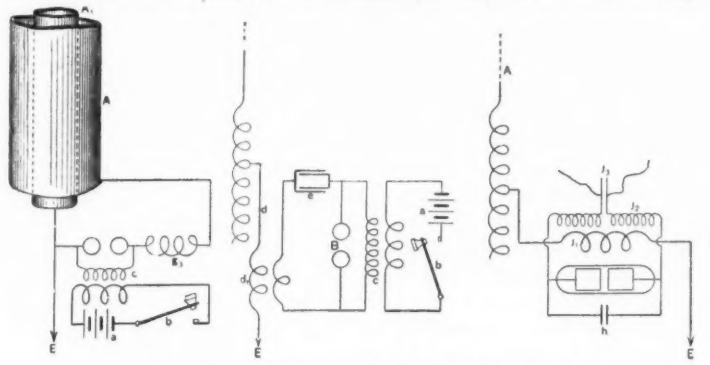
parts, by weight, of pure nitrate of silver to 100 parts of distilled water free from chlorine, and it must not be used after 3 grammes of silver per 100 cubic cm. of the solution have been deposited electrolytically. The part of the anode within the liquid is to be of pure silver and the cathode of platinum. When the silver deposited on the latter exceeds 0.1 gram per square centimeter, the silver must be removed. The current density is not to exceed 0.2 ampere per square centimeter at the anode and 0.02 ampere per square centimeter at the cathode. Before weighing, the cathode has to be washed with distilled water free from chlorine until the rinsing water shows no cloudiness when a drop of hydrochloric acid is added to it, then it is to remain in distilled water at 70 to 90 degs. C. for 10 minutes, and again rinsed in distilled water. This last rinsing water must not show any cloudiness when treated cold with hydrochloric acid. The cathode is then dried in hot air, and kept in a dessicator until it is weighed, and after it has been cooled at least 10 minutes must elapse before the weighing. In addition to the volt, ampere and ohm the names ampere-second and coulomb, ampere-hour, watt, watt-hour, farad, henry, the prefixes kilo, mega or meg, milli, micro or micr, and the terms effective, mean, "electrolytic" and maximum momentary value of alternating or variable currents or e. m. f.'s, are now also legalized. The "electrolytic" value of a current is the average of the momentary values of the current, taking into account the sign, while the "mean" value is the average of all instantaneous values without regard to their sign. The limits of error of commercial electricity meters are also fixed.—*Elek. Zeit.*, May 23; Lond. *Elec.*, May 24.

REFERENCE.

Meters.—ARMAGNAT.—An illustrated description taken from English patent specifications of the new electric meters. The Hookham meter, the Bergmann ampere-hour meter, the Northey ampere-hour meter, the Johnson & Murday watt-hour meter, the Tourtel meter, the Halsey ampere-hour meter, and the Reison meter, are described and illustrated.—*L'Eclairage Elec.*, May 11.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Telegraphy.—MARCONI.—The first part of a well illustrated paper, read before the Society of Arts in London, on his experiments with syntonic wireless telegraphy. His system consists in tuning the receivers to certain wave lengths, and in making the transmitter send out a train of waves of that period to which the transmitter to be affected is tuned. The practical difficulty was to find a transmitter which is a persistent oscillator. He has solved this problem in making use of the general physical principal of resonance. His transmitter sends out persistent waves properly tuned. The former transmitter used in wireless telegraphy with one vertical wire was ineffective for this purpose, as it was too good a radiator, so that all its energy was radiated in only one or two swings,



FIGS. 1, 2 AND 3.—WIRELESS TELEGRAPHY.

and the waves were very greatly damped immediately. A transmitter, which is not only a good radiator but also a persistent oscillator, was devised by him by increasing the capacity of the radiating wire without in any way increasing its radiative power, as shown in Fig. 1, where two cylinders instead of a single vertical wire, are used. The inside cylinder is earthed, while the outside one is connected to an inductance and a spark-gap. The same arrangement of cylinders may also be used in the receiver. The results obtained by this system have been remarkable. When he used an inductance between the spark-gap and the radiating conductor, he found it possible to cause the electric period of oscillations of the receiving cylinder to correspond to that of one out of several transmitting stations, from only one of which it would receive signals. By using cylinders of zinc 7 meters high and 1.5 meters in diameter, good signals could easily be obtained over a distance of 31 miles, these signals not being interfered with or read by other wireless telegraph installations in the immediate vicinity. It is probable that the great majority of the electrostatic lines of force pass directly from one cylinder to the other. The capacity of the radiator due to the internal conductor is so large that the energy set in motion by the spark discharge cannot all radiate in one or two oscillations, but forms a train of slowly damped oscillations, which is just what is required. Another very successful synchronized transmitter and receiver system was the outcome of a series of experiments carried out with the discharge of Leyden jar circuits. The synchronized transmitter is shown in Fig. 2, and the synchronized receiver in Fig. 3. In the transmitter the two electrical circuits B e and A d E must be tuned to the same period of oscillations in order to give good results. The period of oscillation of the vertical conductor A can be increased by introducing turns, or decreased by diminishing their number, or by introducing a condenser in series with it. The condenser e is constructed in such a manner that its electrical capacity may be varied. In the receiver shown in Fig. 3 the vertical wire is connected to earth through the primary of a transformer, the secondary of which is joined to the coherer. In order to make the tuning more marked, he places an adjustable condenser across the coherer. The free period of electric oscillations A j_1 E should be in electric resonance with j_2 h. The condenser h increases the capacity of the secondary resonating circuit of the transformer, and in the case of a large series of comparatively feeble but properly tuned electric oscillations, being received, the effect of the same is summed up until the e. m. f. at the terminals of the coherer is sufficient to break down its insulation and cause a signal to be recorded. In order that the transmitter and receiver are in tune, it is necessary that the product of capacity and inductance in all four circuits should be equal, the resistance being assumed to be very small; but the measurement or calculation of the inductance is not so easy. Experiments, however, confirm the fact that the receiving induction coils having the secondary wound in one layer and at a certain distance, say, 2 mm., have a time period approximately equal to that of a vertical conductor of equal length. If he, therefore, uses an induction coil having a secondary 14 meters long on the receiver, he also uses a vertical wire 14 meters long at both transmitting and receiving stations. By so doing he has the two circuits at the receiving station in tune with each other, and he only has to adjust the capacity of the condenser at the transmitter, which can easily be done. Besides this most successful arrangement, he describes others also, which he has tried. He gives a full history of his experiments. The paper is to be concluded.—Lond. *Elec.*, May 24.

An editorial discussing Marconi's paper from a very broad point of view. It is said that Marconi has successfully perfected methods of syntonic wireless telegraphy, but it is question whether the accurate tuning of sending and receiving apparatus to a definite wave length is the only conceivable or probable or even the best solution. In syntonic signaling the ether waves are not guided. They spread out in all directions, although they only do useful work in one direction. Much energy is therefore wasted. A guided wave method would be much more efficient, but has not yet been made practically effective. For other forms of signals, guided waves are used, as in the heliograph, the lighthouse, the searchlight, the speaking trumpet, etc.—Lond. *Elec.*, May 24.

Wireless Telegraphy.—An article on Blochmann's theory of wireless telegraphy. As has been noticed before in the Digest, this author points out that the atmosphere which acts as medium of transmission, is not in a state of electrical equilibrium, but is subjected to a severe electrical strain by the permanent electrostatic charge in the earth. This strain may be represented by a series of equipotential surfaces enveloping the earth. The vertical antenna of a transmitting apparatus pierces these equipotential surfaces in a normal direction and the disturbances produced by the intermittent charges of electricity sent into the wire, have their greatest effect in an axial direction. The electric waves spread out in every direction along the equipotential surface, following all the irregularities of its surface. A horizontal antenna is comparatively ineffective, because the maximum potential disturbances at its terminals are not normal to the equipotential surfaces. A combination of the theories of Slaby and Blochmann, "if not complete in every detail, appears to be correct in the main."—Lond. *Elec. Rev.*, May 17.

REFERENCES.

Repeater for Wireless Telegraphy.—The first part of an illustrated account of Guarini's wireless telegraphy experiments, made with

his automatic repeater between Brussels, Mechlin and Antwerp, as noticed before in the Digest.—Lond. *Elec. Rev.*, May 24.

Telegraphy and Telephony.—A summary of the progress and improvements, made in telegraphy and telephony during the first three months of this year.—*Elek. Anz.*, May 19.

MISCELLANEOUS.

Electric Pulverization of Metals.—A. Z.—An article in which he says that industrial production of powdered tin, aluminum, copper, etc., is already of commercial importance. He describes an electric method devised by Barry for pulverizing metals. It is based upon the fact that when an electric current flows through an electric conductor, it tends to diminish the diameter. An experiment showing this is described, as is also an interrupter based upon this principle, in which a column of mercury is interrupted by a current flowing through it. For the pulverization of tin he proposes the following apparatus. A crucible, filled with molten tin, has a hole in the bottom, into which is screwed an iron tube, the lower end of which has a small opening through which the tin flows off in a continuous stream into a lower cup. An electric current is sent through the tin; this causes the pulverization of the thin tin stream, the pulverized tin being carried away by a current of gas. For the production of stannic acid, air is used as gas, while for the production of metallic tin a neutral gas like hydrogen is used.—*L'Ind. Elec.*, April 25.

REFERENCES.

Bunsen.—Ostwald.—An address read before the German Electro-Chemical Society, on the life and work of Bunsen. He proposes to change the name of that society into the German Bunsen Society. —*Zeit. f. Elektrochemie*, May 16.

Laboratory.—An illustrated description of the Williams Proudfit Memorial Laboratory of the Rennselaer Polytechnic Institute, of Troy. It is used as an electrical and testing laboratory.—*Polytechnic*, May 27.

Paris Exposition.—Reyval.—An illustrated description of several exhibits of Ganz & Co., a 100-kilovolt-ampere three-phase alternator, a 300-kw single-phase transformer, and a 60-kw direct-current machine.—*L'Eclairage Elec.*, May 11.

The conclusion of the illustrated serial, giving some remarks on the Rieder process of electric etching, a small rotary converter for reducing the pressure of supply mains for medical purposes or for charging small accumulators, the accumulator cars of the Milan-Monza Railway, and the system of electro-pneumatic signals of the Westinghouse Brake Co.—Lond. *Elec.*, May 24.

New Books.

Steam Boiler Economy. A Treatise on the Theory and Practice of Fuel Economy in the Operation of Steam Boilers. By William Kent, A. M., M. E. New York: John Wiley & Sons. 458 pages, 134 illustrations. Price, $4.

This book is the outcome of an active life of engineering work, no small part of which has been spent in the study of the steam boiler and the conditions of its efficient performance. In the preface the author calls attention to the fact that in most of the books relating to the steam boiler, the larger space is given to varieties of form, details of construction, etc., rather than to the conditions which affect the efficiency of the performance. In the present book this order is reversed, and the chief place is given to the points which affect more directly the question of economy of performance.

The work, as a whole, is divided into 17 chapters, covering the following principal topics: The Chemistry of Fuel and Its Combustion, Coal and the Coal Fields of the United States, with a Discussion of the Tests of the Heating Values of American Coals; Special Fuels Other Than Coal; Furnaces and Fittings, Firing, Smoke Prevention, etc.; a general discussion of the action of boiler heating surface, and of the relation between the various factors which affect the efficiency of such action; The Principal Types of Steam Boilers on the Market; The Points of a Good Boiler; Boiler Troubles; Boiler Tests, with a Copy of the Code of 1899, Adopted by the Boiler Test Committee of the A. S. M. E., of which committee the author was a member; Tables of the properties of Water and Steam, Factors of Evaporation, etc. The chapters on the coal fields of the United States and on the tests of heating values are especially full, and bring together in convenient form a large amount of information on these topics.

The discussion of the general question of efficiency leads the author to a formula which, according to the preface, contains all the variables affecting the problem which are measurable, together with a so-called "coefficient of performance," which must be derived from the results of boiler tests, and is useful in comparing one test with another. While the author calls rather special attention to this formula, a doubt may be permitted as to whether its use will aid very materially in the discussion of boiler economy. The measurable quantities will vary between wide and uncertain limits, and it is too much to expect that one coefficient of performance can properly provide for all the non-measurable quantities and their variations. The discussion attending the development of the formula is, however, based on the known laws of heat, and will aid in giving a good understanding of the general relation between boiler economy and the conditions upon which it depends.

In the chapter on the types of boilers found in American practice, the selections for the most part seem to have been made with good judgment, though doubtless many builders will object to finding no mention of their particular type. In the references to water tube boilers one or two prominent types seem to have been omitted, while others are found whose importance may at least be called in question. This chapter is illustrated with cuts of the various types described. These cuts are, however, of quite unequal value, some being small trade catalogue cuts, while others are excellent specimens of technical illustration. Other parts of the book are also illustrated as the needs of the subject matter require.

Taken as a whole, the book is an exceedingly valuable contribution to the literature of the subject. The author's style is excellent and the subject matter is logically arranged and clearly presented. The author's experience has been such as to give him exceptionally good opportunities for acquiring the training and material necessary for the preparation of a book on this subject, and he seems to have used these opportunities to most excellent advantage. The work may be recommended heartily to all who are interested in the subject of the economical generation of steam in the various forms of modern steam boilers.

Engineering Practice and Theory. For Steam Engineers. By W. H. Wakeman. New Haven: W. H. Wakeman. 184 pages, illustrated. Price, $2.

The author naively remarks in his preface, "The study of well written books is one of the most advisable ways of gaining knowledge, and that this volume may be considered an addition to those works which have proved to be of interest and value is the sincere wish of the author." We are afraid that the candid critic will meet some obstacles in the way of pronouncing the book "well written," although he may find in it material "of interest and value." For example, Chapter 9 is headed "Planimeters, Compound Engines, Horse-Power Constants," a somewhat grotesque combination in itself, but the treatment is unique; at least, we hope it is. The author says, "The process of dividing a diagram into a number of spaces, and taking measurements in order to determine the mean effective pressure, is a slow one—altogether too slow for this age of the world—and to shorten it, instruments called planimeters have been devised." He mentions four planimeters which he says are "among the most important," and then blandly informs the reader that "full directions for their use may be found in catalogues illustrating them, published by manufacturers or dealers." This is absolutely all the information on the subject contained in the chapter, unless a reiteration of the statement that the planimeter saves time and the insertion of illustrations of two planimeters, be considered information. If the author really thinks he has said anything worth saying about planimeters he might apply the same method to the engines themselves, thus: "Manual labor is altogether too slow, etc., and to shorten it machines called steam engines have been devised; full directions for their use may be found in the catalogues of dealers." The only point of view from which this mode of treating a subject is advantageous is that it saves brain fatigue to the author in this rapid age, when most persons' brains are said to be overworked.

The author has another little way, apparently all his own, too, of filling in all spaces at the ends of chapters with advice on professional ethics somewhat in the "Poor Richard" style. Unfortunately, space limits allow us to quote only one. "An Axiom.—When an engineer is notified that after a certain date his services will no longer be required, he should run his engine to the specified time, and leave

everything in good order for his successor." This is sound, moral advice, whether one thinks it germane to the subject matter of the book or not, and the same may be said of the other paragraphs used as fillers in the book.

One of the characteristic features of the book is the carefully edited advertising department following the reading matter. Some of the gray matter saved by the author on the description of planimeters seems to have been devoted to this section. A short dissertation on, for example, "Repairing Valves," is printed on one page, and on the opposite page is printed the advertisement of a valve embodying the features commended in the dissertation. It is to be sincerely hoped that the advertisers who are thus favored have duly appreciated the kindness of the author, and have shown their gratitude in a suitably substantial manner, for a failure to do so would constitute so great a breach of the most fundamental rules of ethics as to call for more moral soliloquies in the chapter "fillers" of the next edition.

Directory of Electrical Societies, Etc.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Next meeting, Buffalo, N. Y., June 19, 20 and 21, 1901. (See Current News and Notes.)

CANADIAN ELECTRICAL ASSOCIATION. Next meeting, Ottawa, Ont., June 19, 20 and 21, 1901. (See Current News and Notes.)

NORTHWESTERN ELECTRICAL ASSOCIATION. Next meeting, Sheboygan, Wis., June 26, 27 and 28, 1901.

OHIO ELECTRIC LIGHT ASSOCIATION. Next meeting, Put-in-Bay, Ohio, Aug. 20, 21 and 22.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Next meeting, York, Pa., Sept. 4, 1901.

UNITED ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK. Next meeting, Buffalo, N. Y., July 17, 1901.

INDEPENDENT TELEGRAPH ASSOCIATION OF WISCONSIN. Next meeting, La Crosse, June 25 and June 26, 1901.

The Ringing Dynamotor and Motor Generator for Telephony.

BY D. M. BLISS.

WHILE the amount of energy required for signaling purposes is small compared with that used in charging for direct transmitter service, the selection of ringing or testing generators best adapted to any given case, demands knowledge born of experience, or at least a familiarity with the present state of telephone practice.

There are several factors in the problem at the present time which were unknown in the early days of telephone engineering, and this must be kept in mind in order to secure the best results. The old hand or magneto power generator is rapidly disappearing from the exchange, and in its place is found the more efficient and compact dynamotor or motor generator. As there is some confusion regarding the use of these terms, an explanation just here may not be amiss. Most manufacturers of such apparatus have by common consent selected the name "dynamotor" to indicate a machine having a double-wound armature with a single field system common to both windings, while a "motor generator," as the word indicates, is simply a motor and dynamo, each complete in itself, connected together by belt or coupling and mounted on a common base.

In the dynamotor (Figs. 1, 2 and 3) one of the two independent armature windings, together with the field form the primary or motor part of the machine; the other armature winding generates a current when driven by the motor winding. The voltage of this secondary or generator current is proportioned to the speed, number of turns and strength of the field. The current may be direct, alternating or pulsating in character, according to the arrangement of the windings and the commutator or collector.

Considering efficiency alone, the dynamotor type of ringer is to be preferred, but in a machine in which the total input at the motors may not exceed 200 watts, the question of efficiency is secondary to absolute reliability and perfect insulation. As the primary or motor end of such a machine is frequently operated from 500-volt circuits, and the generator or ringing end always supplies outside circuits, some of them several miles in length, such a machine is peculiarly susceptible to accidents from outside sources, lightning and inductive discharges. It is evident, therefore, that when such an accident happens on one winding, the other is sure to be damaged, as they are both on one core and usually wound together in the same slots.

A characteristic feature of the dynamotor or double-wound type is that the ratio of transmission between the windings cannot be varied, as they are both under the influence of the same field, and therefore any variation of the field strength simply changes the speed, the voltage of the generator end remaining practically unchanged. A slight regulation of e. m. f. may be secured by giving the brushes a forward or backward lead where the design of the machine will admit of it and within the limits of sparkless commutation, or a controlling rheostat may be used in the motor armature circuit, but does not mean satisfactory regulation if the machine is of any size.

A machine of this type is shown in Fig. 1, arranged for delivering a ringing current at the generator end. This dynamotor is used

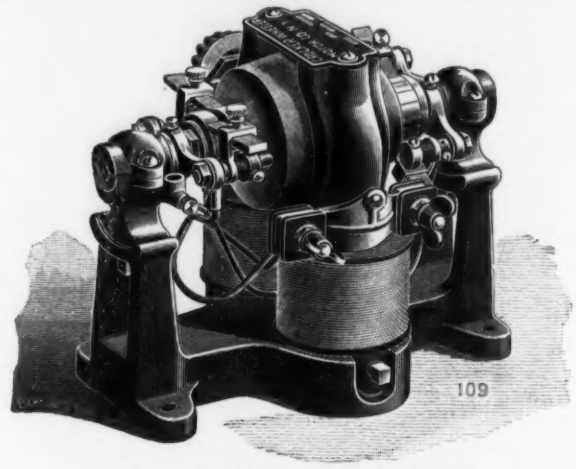


FIG. 1.—DYNAMOTOR TELEPHONE RINGER.

very extensively for general telephone and telegraph purposes, and was one of the first of its class to appear on the market. It has displaced many cells of battery for main and local telegraph work.

A good illustration of the economy and durability of the dynamotor when operated under favorable conditions is shown in the generating plant of the Boston Fire Alarm system, in which 30 special dynamotors of the Fig. 3 type, designed by the writer, have been in continuous operation for over six years, supplying the entire system directly, no storage nor other batteries being used in connection therewith. In this case, nearly all the fire alarm circuits are underground, and the construction is of the best. This fact, and the numerous protective devices used in such a system have eliminated the possibility of lightning or sneak currents damaging the windings. So far no interruption has occurred, and the operating expenses of the plant are but a fraction of those under the old system, which included a gravity battery plant of over 2000 cells, with the services of

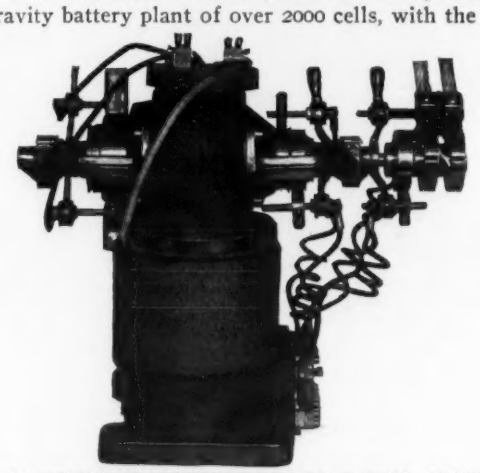


FIG. 2.—TELEPHONE RINGER WITH PULSATING CURRENT.

two or three men constantly employed in keeping the batteries in good order.

An interesting modification of the double-wound type is shown in Fig. 2. This machine delivers at the generator end a pulsating current, as well as the usual alternating or ringing current. The armature for one winding is tapped at certain points, and the current led through the collector to a small stationary transformer. This transformer may have a higher or lower e. m. f. than the primary. The advantage claimed by this method is that the secondary or telephone service may be more effectively insulated than is possible when the

windings are on a single armature, and it is especially recommended when 220 or 500-volt motor service is available.

The tendency, however, with leading telephone companies is to use motor generators or coupled machines for both charging and ringing purposes. Figs. 4 and 5 give illustrations of this class of construction. Where the conditions will permit, the machine should invariably be coupled by noiseless flexible coupling. In cases where the supply current is alternating and of high frequency, it will be found difficult to find a motor of sufficiently low speed to admit of direct coupling to a ringing generator.

The proper speed for ringing as well as for charging generators is from 900 to 1000 r. p. m. A speed much in excess of this will give too rapid alternations to operate the strikers of the system, especially on bridging bell circuits, which require a comparatively low frequency. Where two machines cannot be coupled, belting must be used, and the best results will be obtained by using a thin, endless rawhide belt not less than one inch wide and thoroughly stitched. At least one of the machines should be adjustable to admit of tightening the belt.

It may be of interest to include specifications for ringing motor generator covering the features now demanded by the leading telephone companies.

The advantages of the motor generator over two machines combined are several, in the writer's opinion, as follows:

First.—The generating e. m. f. may be varied to any desired extent without affecting the speed of the motor, or the r. p. m. may be regulated within considerable limits without affecting the generating e. m. f.

Second.—The two machines are completely insulated from each other, and an accident to one armature will not be followed by damage to the other winding, as is usually the case in the dynamotor type.

Third.—The parts of the individual machines are usually standard and kept in stock by the manufacturers, hence the delay in making repairs or getting new parts is reduced to a minimum.

Specification for 75-watt Motor-Generator for Ringing and Party Line Service.

General.—This combination shall consist of a generator and motor for delivering a ringing current of not less than 75 watts output, and it must also be arranged for delivering a pulsating current suitable for selective signaling on party-line service. All materials used must be of the best of their respective kind, and the workmanship and finish shall be first class in every respect. The machine shall be so constructed and balanced that when running there will be no vibration or noise.

Bearings and Brushes.—The machines must be provided with self-oiling phosphor bronze bearings, which must be self-aligning and fitted to the armature shaft so that they will run without heating. Carbon brushes must be used of ample length and section fitted to self-feeding brush holders in which the carbons will maintain their proper position on the commutator under uniform tension throughout the life of the brush. The brush-holders must be carried by a movable brush ring, rocker arm or other similar device, and fixed brush-holders will not be accepted.

Type of Generator.—The generator shall be of the semi-enclosed or protected type, and no machine having the armature connections exposed or with loose and frail connection cables will be accepted. Preference will be given to a form in which armature, field and brush leads are within the casing or frame.

Generator Windings.—The machine must deliver continuously an alternating current of one ampere at 75 volts pressure, at a speed of not more than 1050 nor less than 950 cycles per minute. The voltage on open circuit must not exceed 110.

Pulsating-Current Device.—In addition to the usual collecting rings this generator must be provided with a special commutator containing two conducting segments insulated from each other and from the frame of the machine. Each segment must be permanently connected to opposite points on the armature winding. Carbon brushes must be so placed on these segments so as to receive respectively the positive and negative impulses of the alternating current.

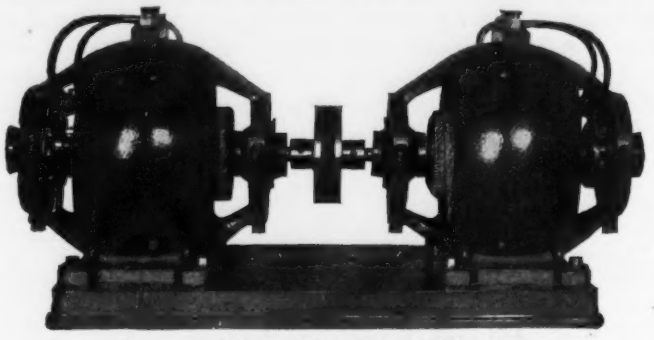


FIG. 4.—SEMI-ENCLOSED MOTOR GENERATOR.

Motor.—The motor must be of the iron-clad induction type, designed to operate on a single-phase alternating current of 104 volts and 60 cycles. It must be self-starting, and of suitable size to drive the generator to which it is connected.

Heating.—The machines must carry their full rated load coninuously without any part of them being heated more than 50 degs. F. above the surrounding air.

Insulation.—The insulation resistance between any insulated part and the frame or another insulated part shall not be less than one megohm.

Terminals.—All terminal blocks shall be of ample capacity, readily accessible and plainly marked. Complete diagram of connections must be furnished.

Sub-Base and Coupling.—The generator and sub-base shall be mounted on a cast-iron planed sub-base, on which the two machines must be accurately centered and connected by a flexible insulated coupling.

Efficiency.—The commercial efficiency of the combination should not be less than 40 per cent. Preference will be given to good workmanship and noiseless operation rather than high efficiency.

FIG. 3.—DUST-PROOF RINGING DYNAMOTOR.

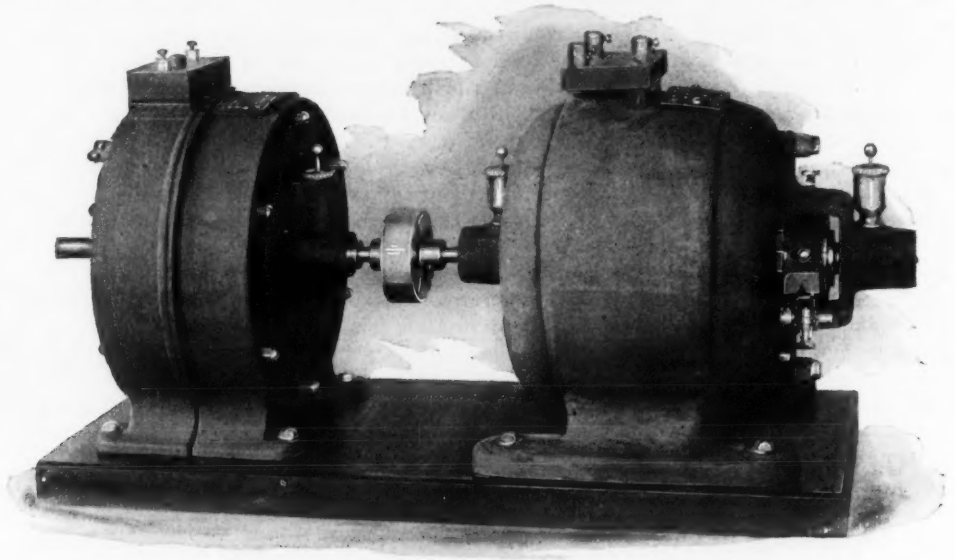


FIG. 5.—ALTERNATING AND DIRECT-CURRENT TELEPHONE MOTOR GENERATOR.

A New Street Railway Generator.

The accompanying illustration shows a type of street railway generator manufactured by the Thresher Electric Company, of Dayton, Ohio. The manufacturer makes strong claims for efficiency in generation and in operation of this type of generator, based upon the machines now installed. The machine has proved equal to the severest service, operating under varying loads ranging from zero to 50 per cent overload within a few seconds, and requiring no attendance further than cleaning and oiling. The polar projections of the field are made separable to permit the field coil to be removed without dismantling the machine as a whole. The pole piece is made either of soft, cast or laminated steel, and the joint, with the frame, is scraped to a bearing to decrease the reluctance to a minimum. This method of construction gives a perfectly balanced field, the reluctance being the same in each circuit, and the pole pieces exactly spaced, a condition which does not exist, it is claimed, when the pole pieces are cast into the ring. The field coils are wound on metallic shells and insulated with a moisture-excluding material. The series and shunt coils are entirely independent to allow perfect ventilation, and in case of accident to either, to permit the damaged part to be repaired without disturbing the other windings.

In the armature construction the features sought have been compactness, solidity and perfect ventilation. Each disk consists of a thoroughly annealed lamination, insulated with Japan varnish. The

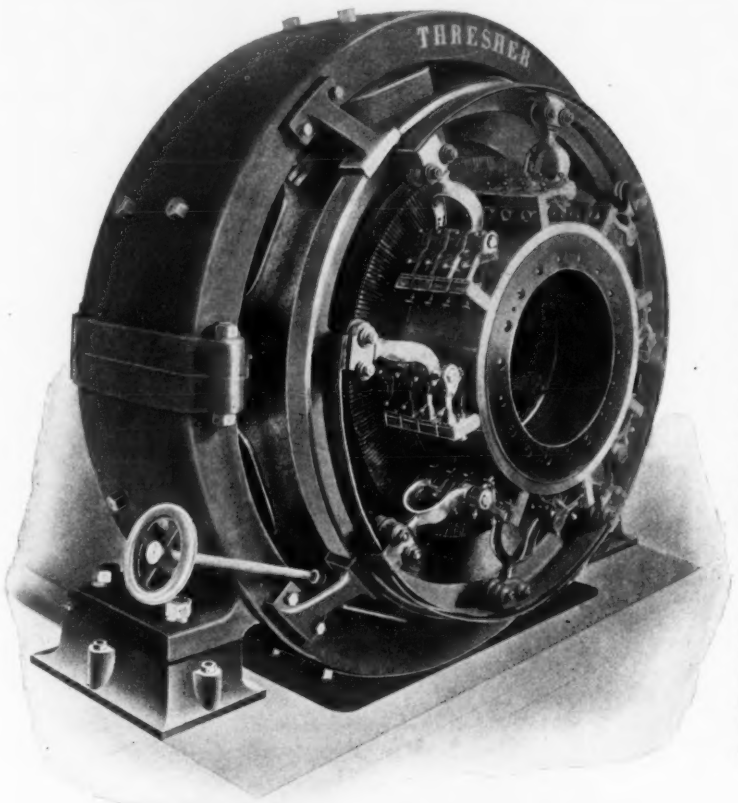


FIG. 1.—STREET RAILWAY GENERATOR.

disks are firmly held in position on the spider by end plates, which are provided with extended flanges to support the windings at both ends, the rear flange being so shaped as to entirely protect the windings from injury. The spider is of open construction, and ventilating disks are provided, to allow the free circulation of air throughout the core body. Projecting from the front end of the spider are lugs, which support the commutator bushing, so that it is entirely independent of the shaft, and being rapidly supported in this manner, all vibration is taken out of the connecting leads. Fig. 2 shows the armature core insulated ready for winding, with the commutator in position. Each armature circuit consists of a continuous copper bar, without joint, formed to shape and completely insulated before being placed on the core, the only joint being where the winding is soldered to the commutator leads at a point easily accessible for inspection and repair. The coils are held in position in the slots by wedges, so that no bands are required upon the core body. This form of winding has many advantages over any other, as will be readily appreciated. It greatly increases the efficiency of the armature by giving the least possible length of circuit, reducing the internal resistance to the lowest limit, and by offering a greater radiating surface, a cooler running armature. It also makes the removing and replacing of a field coil a very simple operation, as a new coil can be inserted by exposing the surface of the armature covered by two pole pieces, without at all dismantling the balance of the machine.

The commutator is built up in a separate bushing, carried on the armature spider entirely independent of the shaft, so as to be easily removed and replaced by a new one when necessary. The commutator bars are of drawn copper, and insulated with India mica of such character as to wear evenly with the bars. They are firmly held in position by the end flanges, and after being put through the several

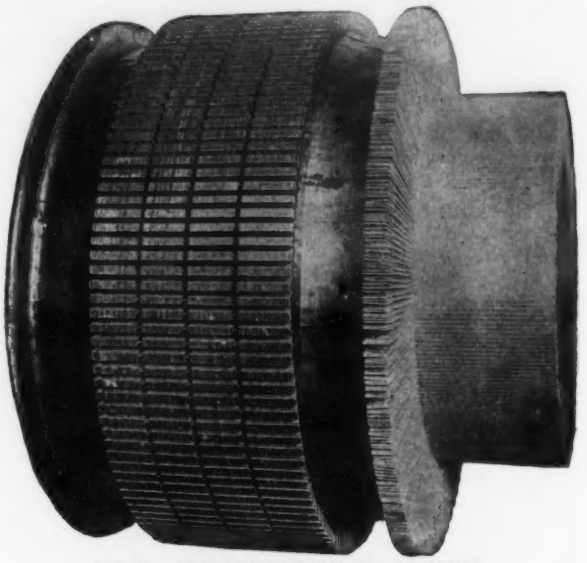


FIG. 2.—ARMATURE READY FOR WINDING.

processes used in the Thresher construction, a loose bar is almost impossible, insuring a very smooth running commutator.

The brush holders are of the radial type. Each brush is firmly clamped in a socket at the outer end of an independent arm, working freely upon the supporting stem. An even and constant pressure upon the commutator is maintained by a spring adjusted through a ratchet on the arm, and attached at its lower end to a central operating lever, fitting closely to the stem and held in position by a pawl. This spring is insulated from the holder to avoid its acting as a conductor and destroying the temper. A flexible connection extends from the brush support to the fixed portion, giving a positive metallic connection. An extra groove is provided in the stem, so that each brush can be held upright and returned to its former position without changing the spring adjustment.

The stem carrying each set of brush holders is supported by a yoke projecting from an adjustable ring of rigid construction, and from which it is thoroughly insulated, provision being made for adjusting each set of brushes independently. This ring is supported concentrically with the commutator by arms extending from the field frame and provided with a screw adjustment, operated by a hand wheel at the side of the ring, as shown in Fig. 1.

Electric Bell Floor Tread.

We illustrate herewith a new attachment for dining-room bells, which is being placed on the market by the Renim Specialty Company, No. 15 Federal Street, Boston, Mass. The object of this de-

ELECTRIC BELL FLOOR TREAD.

vice is to overcome defects of the old style floor-push and cord. It is known as the "Ideal" floor tread, and consists of two heavy spring brass plates 4¾ inches long by 3½ inches wide, with rounded edges,

finished and lacquered. The plates are securely fastened to an insulating strip, through the center of which is drilled a hole for admitting the conducting cord, and binding attachments are provided one on either side for connections, as shown. A heavy felt is firmly cemented to one side, and the whole forms a broad, thin, flat pad, always in position for operation either under or over carpet or rug.

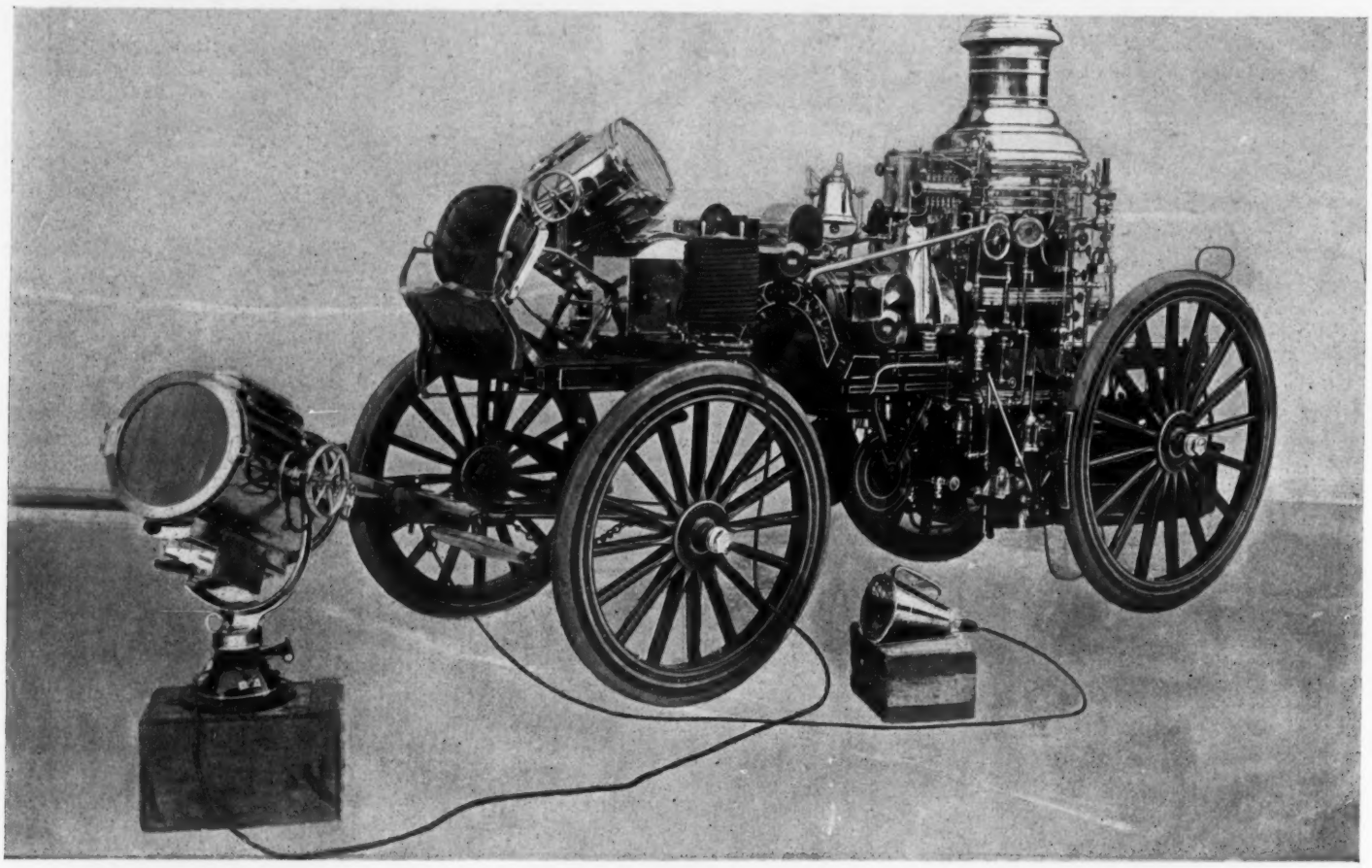
The device may be used either under or over a carpet or rug or on a polished floor. It is not necessary to make any holes in the rug, and there are no projecting floor plugs to break or pull out. With a sufficient length of conducting cord, it may be readily shifted to any convenient spot under the table and is operated by a slight pressure of the foot.

Electric Light Fire Engines.

For some time past the New York Fire Department, under the initiative of Chief Croker, has been experimenting successfully with searchlights as an aid in fighting fire. The attention of our readers has already been called to this work, and we are now able to illustrate the latest development in the same direction. The department has now equipped two engines at the Marion Street station with an improved equipment, each carrying two lights, one with a Mangin mirror and the other with a silvered copper reflector, both having the same diameter of 16 inches. Both types have automatic lamps, with horizontal feed carbons, and they are identical in construction. The cases and stands are nickel plated. The mirror light is used for long distances, and is fitted with a 30 deg. divergent lens, so arranged that the beam may be spread vertically or horizontally, as required. The reflector light throws a spreading beam for use at a short range. Each engine carries an extra standard, which can be placed on the street or at any point where the light is wanted. Either of the lights on the engine can be unshipped and placed on this standard, and the light is immediately available for use. The current required by the two searchlights is about 70 amperes, and is generated by a very compact plant carried by each engine. In addition, as will be noted, there is a very handy form of portable incandescent lamp reflector.

These new searchlight fire engines were given their first trial at practical fire fighting on the evening of April 1. Chief Croker reports that they are much better than the earlier examples. They give a more powerful and steady light, are more to be depended on, and the men find them much easier to manipulate.

The accompanying cut shows the apparatus. The engines were built by the La France Engine Company, Elmira, N. Y. The electric plants were constructed by the Bullock Electric Manufacturing Company, and the searchlights were from the works of Charles J. Bogue, 213 Center Street, New York.



ELECTRIC SEARCHLIGHT ON FIRE ENGINE.

Monmouth, Ill., Model Telephone Exchange.

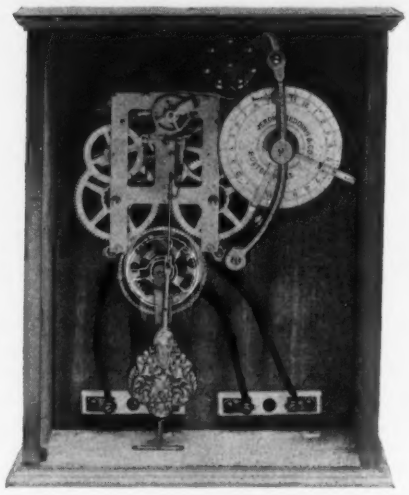
Monmouth, Ill., has one of the best constructed and equipped telephone exchanges in the independent field. It was installed and constructed by the well-known telephone contractors, Jones & Winter, of Chicago, Ill., who have not spared expense in making it a model plant. There are several miles of underground conduit. All wires are cabled that will admit of the same, and the pole lines are of large heavy Norway pines. The apparatus and equipment, consisting of switchboards, terminals, protective devices and instruments are of the well-known make of the Sterling Electric Company, of Lafayette, Ind. The construction and installment of this exchange, although of the highest grade, was so speedy that it enabled them to give service to a portion of their patrons about May 15. They began operation with 300 subscribers, but, like other independent telephone plants which are properly constructed, the demand for service is coming so fast that they will be unable to supply the wants of the constantly increasing number of subscribers.

Automatic Electric Time Switch.

An automatic electric time switch has been introduced by Jerome Redding & Co., of 48 Hanover Street, Boston, intended for lighting and extinguishing lamps, etc., and for other purposes where it is desired to start and stop electrical apparatus at given times, such as signs, motors, etc.

It is adapted for use in stores to light up the lamps in show-windows; in apartment houses, to light the lamps in the halls on the approach of darkness, and extinguish them at the proper time in

the evening, and in all other places where it is desired to light or extinguish lamps, or turn on or turn off the current for any purpose, at more or less frequent intervals. It is also valuable as the main service switch in large buildings to turn off the current at night. It is applicable to the control of the current where flat contracts are made to operate motors, electric heaters, and other apparatus during certain hours of each day, not only for the purpose of securing the exact and automatic turning on and off of the current at the proper



THE TIME SWITCH.

times, but also to prevent the use of the same beyond the time agreed upon and paid for.

Three sizes are made. No. 1 for currents up to 15 amperes; No. 2 for currents from 15 to 75 amperes; No. 3 for currents from 75 to 250 amperes. The No. 1 operates a 15-ampere switch, and is for small currents exclusively. The Nos. 2 and 3 operate knife switches of the proper size and capacity. The cut shows the No. 1 time switch. The instrument is provided with an accurate eight-day clock movement, and a time dial to show the exact time of day, and to operate the switch.

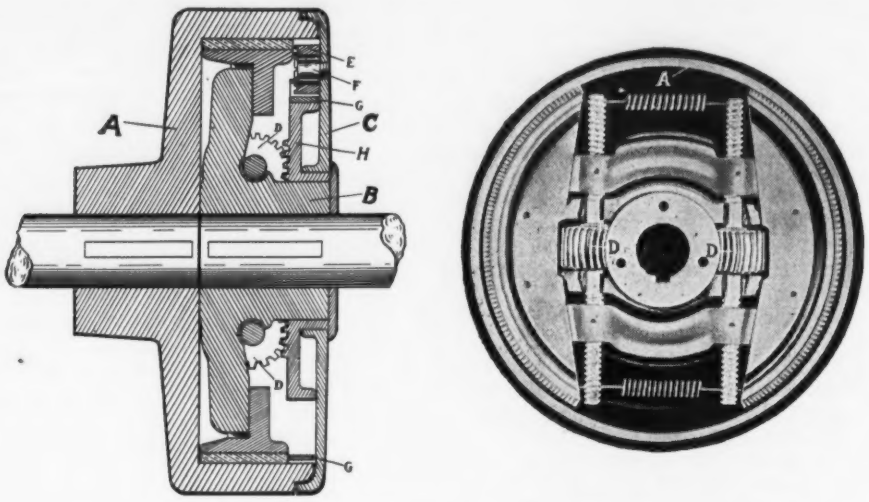
The dial carries two brass arms, one of which controls the opening and the other the closing of the circuit. These arms can be set at any time desired, and when so set are carried around with the dial, and at the designated time operate the switch to open and close the circuit, as desired. The fixed pointer at the top of the dial indicates the correct time of day. As shown in the cut, the movable arms are set to close the circuit at 5.30 p. m. and open it at 11.30 p. m. The fixed pointer shows the correct time to be 8 a. m. The clock can be made to operate the switch at more frequent intervals by placing additional arms on the dial. The day-wheel shown at the top of the cut is for cutting out Sundays and holidays. Each of the seven studs shown on the wheel represent a day of the week. By removing any of these studs the operation of the switch is prevented on the days represented by the studs removed.

The 15-ampere switch is operated by the large gear under the clock movement, and is seen in the cut directly back of the gear.

Automatic Self-Adjusting Friction Clutch.

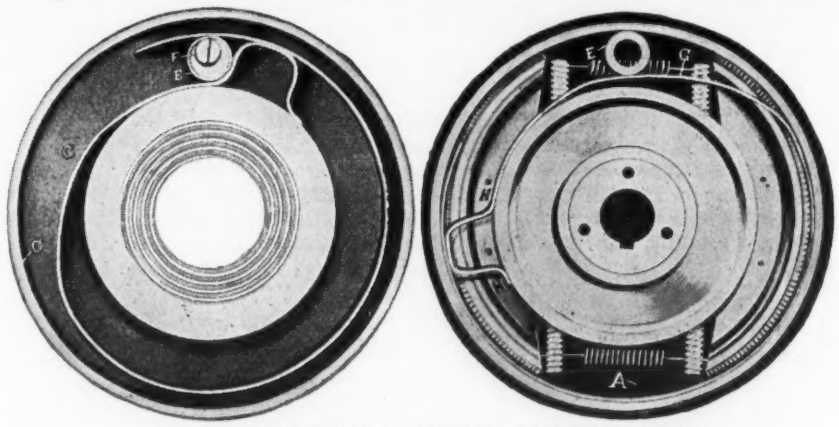
In a paper read before the recent meeting of the New England Cotton Manufacturers' Association, Mr. T. H. Smith, of Jamestown, N. Y., read an article descriptive of a new type of friction clutch known as the "Phillips Automatic Self-Adjusting Friction Clutch," which employs a novel system of mechanism. The construction of the clutch is illustrated in Figs. 1, 2, 3 and 4. Referring to Fig. 1 *A* is a hub keyed to a driving shaft, and in this case provided with an overhanging flange for a belt. A second member of the clutch consists of the driven part, *B*, keyed to the driven shaft, which receives a screw or scroll plate *H*, and carries the gears *D*. Referring to Fig. 2, it will be seen that these gears carry right and left-hand screws which operate wedges having inclined edges in contact with the inclined surfaces of two friction shoes. The springs shown in Fig. 2 are to retract the friction blocks when the clutch is released. The third member (Fig. 1) consists of a starting plate *C*, which revolves independently of the hub and scroll plate. Attached to this starting plate is a bowl *E* (Figs. 1 and 3), loosely mounted on the stud *F*. The spring *G* (Figs. 3 and 4) plays a principal part in the mechanism, and is fastened to the edge of the scroll plate *H*.

The operation of the clutch is as follows: When the starting plate *C*, which is loose on the hub of the scroll plate as shown in Fig. 1, is moved one-fourth of a turn in the driving direction, either



FIGS. 1 AND 2.—AUTOMATIC FRICTION CLUTCH.

by hand or by power, the bowl *E* (Fig. 3) is carried forward on the inclined spring *G* until, as shown in Fig. 4, it makes a contact with the inside rim of the shell or body of the clutch. The spring is then pressed against the inside of the shell sufficiently hard to frictionally hold the scroll plate, which is then driven at the same speed as the driving portion, *A*, of the clutch. The result of this is that the scroll plate will then turn the gears and the left-hand screws, thereby forcing out the wedges (Fig. 2) against the inner surface of the driving part and thus clutching the two shafts. The motion of the screws continues as long as there is any relative motion between the two parts *A* and *B*, and when this ceases the two shafts are frictionally connected. Should the friction shoes slip upon increase of load, the relative motion of the two parts *A* and *B* is resumed, which again starts up the winding motion and retightens the friction blocks. To release the clutch, the plate *C* is retarded either by hand or by a friction shoe worked from the floor. This retardation disengages the bowl *E* (Fig. 4) from the shell or rim *A*. The bowl then runs into a pocket, as shown in Fig. 3, when the spring *G* is released from contact with the rim. This stops the scroll plate, and the worm



FIGS. 3 AND 4.—AUTOMATIC FRICTION CLUTCH.

gears then revolve around the scroll, thereby releasing the friction blocks and stopping the driven part.

The driving power of the clutch is limited only by the bursting strain on the shell. For example, a 20-inch clutch makes 38 revolutions to 1 revolution of the gears, the gears revolve 12 times to give a motion of one-fourth inch to the friction box, and the rim of the starting plate travels 131 times faster than the friction boxes. This rate of gearing accounts for the great force exerted on the shell, and for the slight strain that is brought on the worm and gears.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—In the money market call money ruled at about 3 per cent. Time money is quoted at 3½ per cent for short and 4 per cent for three to six months arrangements. Commercial paper is quoted at 3¾@4¼ per cent for prime double names. The stock market developed considerable activity during the week, which, however, fell off towards the close. In the early part of the week there was decided strength in tone and a number of important advances were recorded throughout the list. In the traction list, however, there was weakness, and the principal securities closed with net losses—Brooklyn Rapid Transit, 1⅝ points and Metropolitan Street Railway, 1¾; General Electric made a big jump on reports that the company would declare a dividend of 33 per cent. The quotation reached 250, closing at 246¾, a net gain of 13½ points. The sales aggregated 2100 shares. Western Union was somewhat weaker, closing with a net loss of ¾ point, on sales of 12,490 shares. In outside securities, the closing half?day session of the week saw little in the way of positive closing half-day session of the week saw little in the way of positive developments, the market, as a whole, being devoid of distinct character. The stocks which declined preponderated over those in which advances were shown, but the changes in both cases were inconsequential. Electric Boat was in good demand, gaining 3 points in the common and 4 in the preferred. New York Transportation, with the $10 assessment paid, closed 11 points above the previous week's price on the old stock, and many of the high class industrial issues showed gains. Following are the closing quotations:

NEW YORK.

	June 1.	June 8.		June 1.	June 8.
General Electric	233¼	246¾	Electric Vehicle	11	11
Brooklyn Rapid Transit	81⅝	80	Electric Vehicle, pfd	17	18
Metropolitan Street Ry	173½	171¾	General Carriage	2	2
American Tel. & Cable	99½	100	Illinois Elec. Veh. Tran.	⅞	⅞
Western Union Tel	94¾	94	Hudson River Tel	120	120
American Dist. Tel	—	—	N. E. Elec. Veh. Tran	3	3⅛
Commercial Cable	—	—	N. Y. Elec. Veh. Tran	1	11½
Electric Boat	19	22	Tel. & Tel. Co. of Am	5	5
Electric Boat, pfd	45	51	N. Y. & N. J. Tel	169	170
Electric Lead Reduc'n	3½	3½			

BOSTON.

	June 1.	June 8.		June 1.	June 8.
New England Telephone	—	—	Erie Telephone	58½	57½
Mexican Telephone	2¼	2½	General Electric, pfd	—	—
Westinghouse Electric	64¼	70	Am. Tel. & Tel	173½	173¾
Westinghouse Elec., pfd	—	75	Boston Electric Light	240*	240*

PHILADELPHIA.

	June 1.	June 8.		June 1.	June 8.
Electric Storage Battery	53	58	Philadelphia Electric	5¾	5½
Elec. Storage Batt'y pfd	60	60	Pa. Electric Vehicle	1	1
Elec. Co. of America	8	8¾	Pa. Elec. Veh. pfd	1	1
General Electric Auto	—	—	Am. Railways	45	45

CHICAGO.

	June 1.	June 8.		June 1.	June 8.
Chicago Edison	173	175	Chicago Telep. Co	260	270
Chicago City Ry	255	250	Union Traction	18¼	18¾
National Carbon	15⅞	16	Union Traction, pfd	58	49
National Carbon, pfd	83	84½	Northwest Elev. com	49	48

*Asked.

AMERICAN TELEPHONE AND TELEGRAPH.—The following financial statement of April 30 has been submitted by the company: Assets.—Construction, equipment and supplies, $16,398,952; telephones, patents, etc., $4,800,689; stocks and bonds, $75,306,150; real estate, $1,653,213; bills and accounts receivable, $5,769,884; cash and deposits, $5,877,742; American Bell Telephone Company, $22,110,400; total, $131,917,030. Liabilities.—Capital stock, $94,237,500; bonds, $15,006,000; profit and loss surplus, $3,961,699; reserves, $2,295,638; bills and accounts payable, $445,982; contingent, $15,970,210; total, $131,917,030. The American Telephone instrument statement for the month ended May 20 shows.

	1901.	1900.	1899.	1898.
Gross output	85,118	54,340	55,302	32,441
Returned	37,744	23,868	21,265	11,948
Net output	47,374	30,472	34,037	20,493
Since Dec. 20:				
Gross output	373,623	290,533	279,627	142,362
Returned	160,348	106,989	76,061	63,645
Net output	213,275	183,544	293,558	78,717
Total outstanding	2,166,091	1,764,049	1,328,808	997,838

CONSOLIDATING OMAHA PROPERTIES.—Plans for consolidating the street railways of Omaha and Council Bluffs, the electric power plants of the two cities, and the Platte River Canal appear to be assuming a definite shape. The new corporation is said to include the Omaha Street Railway Company, the Omaha & Council Bluffs Railway & Bridge Company, the Omaha Thomson-Houston Electric Light Company, the Council Bluffs Electric Light Company, the Omaha Water Company, the Council Bluffs Water Company, the Suburban Railway & Traction Company, and the Platte River Power Canal, and may be capitalized at $20,000,000. The Platte River Power Canal, a franchise for which has been issued by the State, is projected, to be 25 miles long, and to be built across the country from a point 15 miles above the mouth of the Platte River to a terminus with the Missouri River. This canal will divert enough of the water of the Platte River to furnish 30,000 horse-power, to be used in the operation of the railways and water plants. President Frank Murphy, of the Omaha Street Railway Company, has been in New York, conferring with capitalists who are said to be fianancing the deal.

COST OF ABOLISHING THE CABLE.—The recent change of the power system of the Broadway, Columbus and Lexington Avenue cable roads to electricity in New York City, by the Metropolitan Street Railway, has given rise to the question as to how the company would carry this loss on its books. President Vreeland states that as the amount lost was represented by bonds now outstanding on which the company had to pay interest, there was only one way in which it could legitimately appear on the books. The method pursued will be to charge what is known as the capital account with the total amount expended on the cable system (about $16,000,000 for the above-mentioned three lines) and to credit the same account with the amount of salvage (being about $10,000,000), while adding the loss of the difference between the two items ($6,000,000) to the cost of the new motive power. No better illustration of the capacity of electric traction could be offered than the ability that it has of enabling the company to recoup this huge depreciation.

DIVIDENDS.—The directors of the Massachusetts Electric Companies have declared a dividend of $2 per share on the preferred stock, payable July 1. The Nashua Street Railway Company will pay a dividend of $2 per share on July 1. The Union Passenger Railway Company has declared a dividend of $4.75 per share, payable July 1. The West Philadelphia Passenger Railway Company has declared a dividend of $5 per share, payable July 1. The directors of the Commercial Cable Company have declared the regular quarterly dividend of 1¾ per cent, payable July 1. The directors of the Madison Gas & Electric Company have declared the regular semi-annual dividend of 2½ per cent, payable July 20. Directors of the Twin City Rapid Transit Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable July 1.

BOSTON NOTES.—The Northampton & Amherst Street Railway has been authorized by the Massachusetts Railroad Commissioners to issue $100,000 5 per cent 20-year mortgage bonds. The Boston Electric Light Company and the Edison Electric Illuminating Company, of the same city, have been given legal authority to consolidate. Note is made of the listing on the Boston Stock Exchange of $3,600,000 common and $1,250,000 preferred stock of the Seattle Electric Company.

CENTRAL UNION TELEPHONE.—The decline of 9 points from 49 to 40 in the price of Central Union Telephone stock is explained in a circular to stockholders, which sets forth the necessity of various expenditures essential to furthering the company's immediate needs. The company, it is stated, will be assessed $5,000,000.

NORWICH, N. Y., LIGHTING BONDS.—Lawrence, Barnum & Company offer $85,000 Norwich Gas & Electric Company 5 per cent. gold bonds, redeemable after 1911 at 105. The company has averaged for ten years nearly twice the entire interest charge. The mortgage is 68 per cent of the actual cost of the property.

BALLSTON SPA TROLLEYS.—The stockholders of the Ballston, N. Y., Terminal Electric Railroad Company have voted to increase its capital stock from $300,000 to $1,500,000 and its bond issue from $200,000 to $1,200,000 for the purpose of extending the line to Amsterdam, a distance of 21 miles.

GENERAL ELECTRIC.—It is stated that the business now on the books of the General Electric Company is sufficient to keep its plants in full operation for at least two years. The matter of a 33⅓ per cent stock dividend, it is reported, will receive early consideration.

MORTGAGE.—The York Haven Electric Power Company, York, Pa., has given a mortgage to the Security, Title & Trust Company, of York, to secure an issue of $3,000,000 in bonds. Work on the new plant is now in progress.

TELEPHONE BONDS.—American Telephone & Telegraph Company's $15,000,000 collateral trust 4 per cent bonds of 1920 have been transferred from the unlisted to the listed department of the Boston Stock Exchange.

SIEMENS & HALSKE ELECTRICAL COMPANY.—The Siemens & Halske Electrical Company, of Berlin, will issue a loan of 5,000,000 marks at 4½ per cent, the issue price being 100.

TO SUSPEND DIVIDENDS.—It is stated that the San Francisco Gas & Electric Light Company is about to suspend dividends until a floating debt is paid off.

Commercial Intelligence.

THE WEEK IN TRADE.—Reports to the mercantile agencies indicate better trade conditions, owing, primarily, to the warmer weather and better outlook for crops, and reports of improvements come from the East, the Northwest, the South and the Pacific Coast. Iron and steel are quiet in all lines as regards new business; consumption, however, continues at an undiminished rate. The labor situation in many parts of the country is still unsettled, and constitutes a reason for hesitation in some industries, discouraging new operations which satisfactory conditions would otherwise stimulate. The machinists' strike, which is not yet settled, is causing manufacturers to seek no new business beyond July 1. The failures for the week as reported by *Bradstreet's*, number 163, as against 144 the week previous and 184 the corresponding week last year. The failures for the month of May, according to *Dun's Review*, were 873 in number and $7,990,423 in amount, against 947 in May last year for $23,771,151. In the metal market, copper continues firm, and manufacturers in this country are very busy. Quotations are unchanged, Lake being quoted at 16⅞@17 cents; electrolytic in cakes, wire bars and ingots, 16.35@16.45 cents; cathodes, 16.10@16.20 cents, and casting copper, 16.24@16.35 cents.

THE McLOUD RIVER ELECTRICAL COMPANY, of San Francisco, Calif., is now installing four units of Victor turbines with cylinder gate mounted on horizontal shafts, each unit to develop 790 horse-power under 36 ft. working head of water, and running 270 r. p. m. Each unit consists of two 30-inch Victor turbines mounted in a steel flume and discharging into one central draft tube. The flumes are 15 ft. 9 inches long, 9 ft. 6 inches diameter, constructed of heavy steel plate with cast iron heads and covers. The gate work is the draw-rod type, which places all gears on the outside of the flume where they can have attention, and where they can work in oil, doing away with the old style of gate work where the gears run in water, and where they were continually causing trouble. The patents on this style of gate work are completely controlled by the builders of the turbines, the Stilwell-Bierce & Smith-Vaile Company, Dayton, Ohio, U. S. A. The plant is being installed in the northern part of California. The wheels are set on top of concrete arches, the draft-tubes reaching through to the tailwater below. Each unit is equipped with a large rope pulley, and the dynamos are driven by means of rope drive, being located at a higher elevation than the waterwheels. The feeder pipes come through the foundations upon which the generators set, and the whole is a very substantial and complete plant. There are also two exciter wheels, which will develop about 40 horse-power each under 36 ft. head, and the exciters are also driven by means of rope pulleys. The large units are each equipped with a Gies electro-mechanical governor for regulating the speed of same.

RAILWAY CONSTRUCTION SOUTH.—The contract has been awarded for the construction of the Augusta & Aiken Railway, which will run from August, Georgia, through Bath, Warrenville, Langley, Graniteville, to Aiken, South Carolina, a distance of 20 miles, which road has also secured valuable franchises in the city of Augusta. This company will be owned by the North Augusta Electric & Improvement Company, which latter company owns the North Augusta Land Company, North Augusta Development Company, and North Augusta Railway Company. The Board of directors is composed of the following gentlemen: James U. Jackson, J. William Middendorf, R. Lancaster Williams, John Blair MacAfee, Ernest Groesbeck, Alfred S. Elliott, Henry Buist, Walter M. Jackson and Martin Verdry. The road will be built upon private right of way, and will be of standard steam railroad construction, to carry both passengers and freight. Its equipment will include two powerful electric locomotives for freight service. The contract for the complete construction and installation of the road, power plant, and equipment, has been awarded to Mr. John Blair MacAfee, the well known Philadelphia contractor. Mr. Walter Newbold Walmsley will be chief engineer and will be assisted by Mr. G. Edwin Heath and Mr. William Harrison MacAfee, civil engineers, all of whom are associated with Mr. MacAfee.

STEEL RAILS FOR ENGLAND.—Borough Engineer Lord, of the important city of Halifax, Yorkshire, is at present in this country, chiefly with reference to the contract recently placed with the Lorain Steel Company for 4000 tons of steel girder rails and accessories to be furnished the Halifax corporation for use on an extension of that English city's electric traction system. Mr. Lord, it is believed, will make preliminary arrangements while in the United States, with a view to further contracts being placed with American manufacturers for various material equipment, which will be required shortly. He is at present inspecting several of the electrical systems and plants out West, but will return to New York, according to present arrangements, on June 15. While in this city he can be found at the offices of F. Stuart Williamson, consulting engineer, Broad Exchange Building, 25 Broad Street. Mr. Lord returns to Europe on the White Star liner Oceanic, sailing June 19.

CONTRACT FOR FIVE ACCUMULATOR PLANTS.—The Electric Storage Battery Company, Philadelphia, Pa., has recently closed contracts for five chloride accumulator plants to be installed at rotary sub-stations on suburban electric roads about to be built in the vicinity of Pittsburg, Pa., by the same interests which now control the Monongahela Light & Power Company, the Monongahela Street Railway Company, and the Pittsburg & Birmingham Traction Company. Three of these plants will be installed on the Pittsburg & Charleroi road now under construction; one will be located in McKeesport, and the fifth at Springdale, Pa., on the projected Allegheny Valley Street Railway. One of the important objects obtained by these battery installations is to permit current for both railway and lighting work to be taken from the same 60-cycle alternators.

ELECTRICITY IN COPPER WORKS.—The Westinghouse Electric & Manufacturing Company has closed a contract with the Mountain Copper Company to equip the immense works of the company near Keswick, Calif., for operation by electricity. The power contract has been awarded to the Keswick Electric Power Company, which will transmit from its water-power electric-generating station sufficient power to operate the Westinghouse induction motors in the mills and mines. There will be included in the equipment one 500-hp, two 175-hp, one 75-hp, five 50-hp and one 100-hp motors.

BIDS FOR LIGHTING.—The Cuyahoga County Commissioners have opened bids for a lighting plant to illuminate the public buildings. The bids were as follows: R. P. Crawford Heating & Manufacturing Company, $8,335; Lincoln Electric Company, $15,586; Electric Supply & Manufacturing Company, $12,200; Chafer & Becker, $9,400; C. C. Bateson, $9,960; Standard Machinery & Equipment Company, $10,386; John Thompson, $9,500. The bids were referred to George S. Ryder, the engineer who prepared the plans.

MARINE ENGINE COMPANY.—The Marine Engine & Machine Company, Harrison, N. J., is having a new foundry building erected, the American Bridge Company having been awarded the contract for the structural work. The Marine Company is receiving propositions for electric cranes, cupolas and other necessary equipment. The machine shop is operated electrically, and the new departments will also be operated by electricity.

POWER BLOCK.—The Perry-Payne Estate, of Cleveland, is preparing plans for an enormous power block project. There will be a group of seven-story power blocks, embracing two blocks near the center of the city. The promoters expect to realize by the centralization of power supply, and it is proposed to erect a large power station to furnish power for the group of buildings. The buildings will cost about $2,000,000.

CAR MATERIAL FOR GREECE.—The J. G. Brill Company, of Philadelphia, is about to make shipment of 200 tons of car material to Patras, the principal seaport of Greece. The same concern is also completing work on several 21 E electric motor trucks, which are to be forwarded to Dunkirk, France. Four equipments of a similar description will also be sent shortly to Darwen, a town in the vicinity of Liverpool.

MACHINERY FOR MEXICO.—A despatch from Monterey, Mexico, states that the Monterey Steel Works, now being constructed there at a cost of $10,000,000, has just placed an order in the United States and England for more than $1,000,000 worth of machinery for the plant. The machinery is to be delivered by the first of next year. About $700,000 worth of the machinery order went to United States concerns.

THE WAGNER ELECTRIC MANUFACTURING COMPANY announces that it has transferred its special foreign sales office from the Havemeyer Building, New York City, to the factory in St. Louis,

thereby enabling more prompt engineering attention to be given to matters arising in its foreign department.

ENGINE.—The Memphis Light & Power Company, Memphis, Tenn., has purchased a 125-hp compound direct-connected engine from the Ball Engine Company, Erie, Pa.

POWER STATION IN SAN FRANCISCO.—The Market Street Railway Company, San Francisco, is making arrangements to build a 3000-hp electric power station near Black Point, to supply much-needed additional power for its car lines. Oil will be used as fuel.

FANS FOR INDIA.—The Robbins & Meyers Company, of Springfield, Ohio, manufacturer of electric fans, has received a second larger order for fans from Calcutta, India. The foreign demand for electric fans is rapidly increasing, according to this company.

ELECTRICAL EXPORTS.—The following are the exports of electrical material from the port of New York for the week ended May 29: Antwerp—41 cases electrical material, $2,412. Argentine Republic—218 packages electrical material, $5,277; 2 packages electrical machinery, $455. Azores—16 packages electrical material, $145. Brazil—178 cases electrical railroad material, $3,836; 36 packages electrical material, $2,521. British Australia—15 packages electrical material, $8,750. British East Indies—30 packages electrical machinery, $3,600; 2 packages electrical material, $25. Bilboa—314 packages electrical material, $39,913. Berlin—2 packages electrical material, $75; 10 packages electrical machinery, $145. Batoum—2 cases electrical machinery, $1,300. Berne—4 packages electrical machinery, $2,800. British Possessions in Africa—235 packages electrical machinery, $40,000; 34 packages electrical material, $1,900. British West Indies—7 packages electrical material, $49. Chili—6 cases electrical material, $176. Charkow—1 case electrical machinery, $300. Cuba—104 cases electrical material, $2,978. Glasgow—2 packages electrical material, $107; 2 reels cable, $95; 54 cases electrical material, $440. Genoa—45 packages electrical material, $2,183. Hull—5 cases electrical machinery, $716. Havre—14 packages electrical material, $1,267; 13 packages electrical material, $1,470. Hamburg—5 packages electrical material, $1,118; 61 packages electrical material, $1,015. Hayti—3 packages electrical material, $106. Ipswich—1 case electrical material, $121. London—549 packages electrical material, $90,459; 163 packages electrical material, $12,578. Liverpool—117 packages electrical machinery, $30,580; 45 packages electrical material, $2,049. Mexico—371 packages electrical material, $2,200. Manchester—8 packages electrical machinery, $1,537; 2 packages electrical material, $95. Milan—79 cases electrical material, $4,235. Naples—57 cases electrical material, $854. Oporto—1 package electrical material, $169. Peru—32 packages electrical material, $1,449. Rotterdam—6 packages electrical machinery, $111; 10 packages electrical material, $51. Santo Domingo—30 packages electrical material, $635. Southampton—2 cases electrical machinery, $560; 1 case electrical material, $37. St. Petersburg—24 cases electrical material, $450. Santander—23 packages electrical material, $340. United States of Colombia—18 cases electrical material, $293. Venezuela—35 cases electrical material, $1,076. Vienna—1 package electrical material, $50; 2 cases electrical machinery, $1,982. The following were the exports of electrical material from the port of New York for the week ended June 5: Antwerp—8 packages electrical material, $833. Argentine Republic—106 packages electrical material, $4,302. British Australia—227 packages electrical material, $11,267; 10 packages electrical machinery, $415. Brazil—156 packages electrical material, $1,921. Bremen—4 packages electrical material, $154. British West Indies—34 packages electrical material, $617. British East Indies—1 case electrical material, $20. Cuba—11 cases electrical material, $701. Central America—41 cases electrical material, $1,201. Chili—9 cases electrical material, $275. Dutch East Indies—1 package electrical material, $21. Dublin—3 packages electrical machinery, $90. Glasgow—52 packages electrical machinery, $5,442; 23 packages electrical material, $943. Hamburg—31 packages electrical material, $1,181. Havre—49 packages electrical material, $2,628. Hull—2 cases electrical material, $163. Halifax—10 cases electrical material, $476. Japan—170 cases electrical material, $14,056; 4 packages electrical machinery, $4,597. Korea—3 cases electrical material, $73. Liverpool—1 package motor machinery, $210; 33 packages electrical machinery, $2,839; 170 packages electrical material, $4,150. London—44 packages electrical material, $8,677; 91 packages electrical material, $2,682. Manchester—5 packages electrical machinery, $190; 3 cases electrical material, $637. Mexico—111 cases electrical machinery, $4,480; 7 cases electrical machinery, $813. Newfoundland—14 cases electrical material, $400. New Zealand—6 packages electrical material, $120. Nova Scotia—2 cases electrical material, $21; 8 packages electrical machinery, $1,042. Peru—6 packages electrical material, $216; 2 packages electrical machinery, $220. U. S. Colombia—27 packages electrical material, $916. Vienna—4 packages electrical machinery, $300. Venezuela—1 package electrical material, $16. Warrington—84 cases electrical material, $1,764.

TROLLEYS IN RUSSIA.—Consul-General Guenther sends the following, dated Frankfort, April 30, 1901: The first electric suburban railroad in Russia was opened for traffic this year. It connects the manufacturing city of Lodz, in Russian Poland, with the neighboring towns of Zgierz and Pabianice, and is 13½ miles in length. The Thomson-Houston motors used were furnished by the Russian Electricity Union. The road is owned by a company of Polish merchants and manufacturers, and was built at a cost of $560,000. The charter provides that the Government shall receive a share of the profits, and shall have the right to purchase after 20 years, and that the road and all equipment shall become the property of the Government at the expiration of 28 years.

DE LAVAL STEAM TURBINES.—The De Laval Steam Turbine Company has been incorporated, with a capital of $1,000,000. The factory, at Trenton, N. J., will consist of a main building 200 by 210 ft., and three or four smaller buildings, all of brick. It is expected that the factory will be ready about July 1. The officers are Daniel Lorrman, president; R. R. Bowker, vice-president, and Francis J. Arend, secretary and treasurer. It will be remembered that Mr. Bowker was formerly president of the old New York Edison Company, one of the most successful central station corporations in America while under his management. The new company's offices will be established at 74 Cortlandt Street, New York City.

BOSTON PNEUMATIC SERVICE.—The American Pneumatic Service Company began the business of carrying parcels to the different districts covered by its service, including the city proper, South Boston, Dorchester, Roxbury, Jamaica Plain and Brookline last week. It is stated by its officials that the business already in hand is very satisfactory, and a large amount of business is being taken on from day to day. Arrangements have been made with the District Messenger Company for the transfer of messages between the pneumatic tube stations by tube instead of by sending them as heretofore by boy, and this service will be immediately put in operation.

THE ANCHOR ELECTRIC COMPANY, of Youngstown, Ohio, has been incorporated by N. L. Norris, R. T. Hamilton, Charles N. Crandall, Fred Keast, H. W. Davis and Thomas Carr, with a capital stock of $35,000. The company will build and operate a plant for the manufacture of incandescent and arc lamps and other electrical machinery and appliances. A ten-year lease has been secured on a piece of property in Youngstown, and a building 48 by 120 ft., plans for which are now being prepared, will be erected as soon as possible. The company expects to commence operations by Aug. 1, in time to get in on fall and winter business.

INTERNATIONAL CONSOLIDATION.—It is reported that the differences between the officers of the Bethlehem Steel Company and the representatives of the Vicker's Sons & Maxim Company have been adjusted, and that the consolidation is now assured of the English concern and the Cramp and Bethlehem establishment. The consolidation of these two interests was referred to in these columns April 13, 1901.

MEXICO.—V. U. Braschi & Bro., of Mexico City, are now representing the Stanley Electric Manufacturing Company, the Stanley Instrument Company, the John A. Roebling's Sons Company, the General Incandescent Arc Light Company, and other American concerns. They have recently sold a 50-kw Stanley plant complete, including generator, Pelton wheel, wiring, and all auxiliaries. They have two other plants under negotiation, and report an excellent outlook.

EXETER MACHINE WORKS, of Pittston, Pa., are installing a complete coal handling plant, with the Exeter-Le Grand conveyor, for the Oxford Paper Company, Rumford Falls, Me. They have recently shipped six improved 75-hp hoisting engines to Havana, and are now erecting a complete coal handling system for the New York Gas, Electric Light, Heat & Power Company's new station at Thirty-ninth Street.

STROMBERG-CARLSON FACTORY.—News comes from Chicago that the Stromberg-Carlson Telephone Manufacturing Company has acquired the land and 7-story factory building at the southwest corner of Clinton Street and Jackson Boulevard, that city, for $212,000. It has occupied the factory for some time past, and now wants the whole of the building for its growing business.

SWISS ROADS.—London advices state that American manufacturers have secured the contract for electric engines on the Swiss railway up Mount Zermatt.

General News.

THE TELEPHONE.

CHICAGO, ILL.—The Chicago Telephone Company is about to begin the preparation of plans for a new telephone exchange building, which it will erect in Evanston. It will be of brick and stone construction, the interior being fireproof, and will cost $15,000.

CHICAGO, ILL.—The application of the new United Telegraph, Telephone & Electric Company to the city council of Chicago for an extension of territory, in order that they may supply Chicago as well as Hyde Park with telephones, has not yet been acted upon. The company has offered to instal free telephones beside those of the Chicago Telephone Company, which shall be paid for at the rate of five cents for each call. The officers have also offered to make rates one-half lower than those charged by the Chicago Company. To meet this proposition, President John I. Sabin, of the Chicago Company, has arranged a new system on the "pay-for-what-you-get" plan. The instruments are all "nickel-in-the-slot" machines, and will be placed in any house or office where there is a guarantee that the earnings will be a certain amount each day. The new instruments will be in four classes. The first will be on an individual metallic circuit, and will rent for $5.50 a month. For this forty free calls will be allowed, and additional calls will be at the rate of five cents each. The second will be with two subscribers on the line, with a guarantee of twenty cents each day, the calls to be at the rate of five cents each. The third will be on ten-party lines, five cents a call, and ten cents guaranteed each day; and the fourth, for residences only, where the ten-party system is used, and one call a day is to be guaranteed at the message rate of five cents.

MITCHELL, IND.—The Trustees of Mitchell have granted a franchise to the Hoosier Telephone Company, of Salem, for the erection of a modern telephone exchange. The board also granted L. W. Spencer, of Georgia, the right to build a connecting line with his Georgia and Huron system.

WABASH, IND.—Farmers in the vicinity of Lafontaine, this county, have effected an organization to build a telephone exchange. They purpose to establish a central station at Lafontaine and connect the homes of farmers within a radius of eight or ten miles. It is practically assured that the system will be put in at once.

GREENSBURG, IND.—The workmen in the employ of the Decatur County Telephone Company who have been extending wires in every section of this county quit work because the time required in going to and from their work was not paid for. The community is divided in support of the company and the men, and petitions are being circulated asking patrons to withhold their patronage until the latter yields to the demands of the workmen.

INDIANAPOLIS, IND.—An innovation in telephone service has been inaugurated by a local firm of grocers, which has signed a contract with the Central Union Telephone Company for fifty instruments, to be placed in the homes of customers. The telephones are to be used by the customers in placing orders for groceries, and this service is to be free of charge. But should they desire to make other calls, a fee of one cent is charged each time.

CEDAR RAPIDS, IA.—A telephone company has been organized at Story City, with $10,000 capital, and is installing an exchange.

TOPEKA, KAN.—The Wilson County Telephone Company has been incorporated. Capital, $750.

BOSTON, MASS.—The Erie Telephone system made a net gain of 3564 subscribers in May; net gain since Jan. 1, 8545. Total connected May 31, 150,144; waiting connection, 3374.

WORCESTER, MASS.—All but six of the striking linemen of the Worcester branch of the New England Telephone & Telegraph Company have returned to work at the old wages and hours.

FALL RIVER, MASS.—The annual meeting of the Fall River Automatic Telephone Company was held recently in the company's new exchange building on Bank Street, Fall River, Mass. After the reading of the various reports, all of which were approved by the stockholders, the following board of directors were elected: B. D. Davol, E. B. Jennings, R. P. Borden, C. S. Greene, R. J. Thompson, V. A. Sears, R. F. Haffenreffer, J. W. Coughlin, M. Sweeney, B. D. Davol, treasurer; R. P. Borden, clerk. The company has very nearly completed its plant with its underground system, which is designed for 3000 subscribers, on private lines exclusively. The automatic switchboards, furnished by the Strowger Automatic Telephone Exchange, of Chicago, have arrived and are being connected up. The exchange will open for business in July, and will be the largest automatic telephone exchange, at that date, in the world. The population of Fall River is 104,000.

DETROIT, MICH.—The Citizens' Telephone Company, of Grand Rapids, has increased its capital stock from $550,000 to $1,000,000. The company owns 29 outside exchanges and is preparing to build three more.

SAGINAW, MICH.—The Valley Telephone Company has declared a 20 per cent dividend for the period of 30 months between Oct. 1, 1898, and March 31, 1901.

MURDOCK, MINN.—The Murdock-Carlson Telephone Company has been organized by the election of the following officers: President, C. H. Fredrickson; vice-president, L. H. Lawson; secretary, A. L. Bergstrom; treasurer, John Brandt.

ST. PAUL, MINN.—The Twin City Telephone Company, now engaged in modernizing its plant in St. Paul and Minneapolis, has purchased a site in the latter city on which will be erected a $75,000 exchange. It has a frontage of 66 feet, and will allow the erection of one of the largest telephone exchanges in the Northwest. The company will begin work at once, and expects to be in its new quarters by August at the latest. A switchboard capable of accommodating 6400 subscribers will be installed. In St. Paul improvements are being made, principally among the list contemplated being the laying of conduits. Several miles will be laid.

CHARLOTTE, N. C.—The Bell Telephone Company has completed connections between the Columbia, S. C., system and Blacksburg, Spartanburg, Greenville and Orangeburg.

NEW JERSEY.—The Hudson and Middlesex Telephone and Telegraph Company has been incorporated in the State of New Jersey, capital $15,000, to begin operations "at a point under the Hudson River, in the County of Hudson, at the easterly line of said county, where said lines will connect with lines of telegraph or telephone, or both, without the State of New Jersey, and continuing thence through the counties of Hudson, Essex, Union, Middlesex, Monmouth, Mercer, Ocean, Burlington and Camden, to a point under the Delaware River, at the westerly line of said County of Camden, where said line will connect with the telephone or telegraph, or both, without the State of New Jersey." Incorporators, Bryan S. Klotz, Sylvester M. Cooley and Walter P. Lindsley.

BURTON, OHIO.—The Burton Telephone Company, Burton, has increased its capital stock from $5,000 to $15,000.

FINDLAY, OHIO.—The exchange of the Home Telephone Company has been opened for business and about 900 subscribers have been connected up.

POLAND, OHIO.—The Central Union Telephone Company, at Youngstown has secured a number of subscribers in this place, and will build a toll line and branch exchange.

FAIRVIEW, OHIO.—The Union County Telephone Company of this place has been incorporated by C. E. Miller, B. F. Sheppard and others to operate exchanges in Guernsey, Harrison and Belmont counties.

CLEVELAND, OHIO.—The line built by the United States Telephone Company to Beaver has been connected at that point with a line built by the Pittsburg & Allegheny Telephone Company. This connection not only gives the independent telephone interests through service from Cleveland to Pittsburg, but connects the numerous exchanges in Indiana and Ohio with those in Pennsylvania. Before many months through service will be secured to Baltimore, Newark and other Eastern cities.

CUMBERLAND, TENN.—The Cumberland Telephone & Telegraph Company, of Tennessee, has decided to increase its capital stock 20 per cent, to $7,500,000, part of which will be expended in completing a direct line between Nashville and Louisville.

MARLIN, TEXAS.—The Independent Telephone Company, of Waco, is preparing to extend its system to Marlin; also to put in a local exchange here.

SILVERTON, TEXAS.—At a meeting held here capital stock to the amount of $1,200 was subscribed to build a telephone line from here to Estelline, a distance of sixty-five miles.

DALLAS, TEXAS.—The Kiowa & Comanche Telephone Company has been incorporated. Capital stock, $5,000. Incorporators: F. T. Cook, J. A. Tuipel and J. W. Malone, of Cloud Chief.

SEATTLE, WASH.—The consolidation of the two independent telephone companies of Seattle, is making progress. At a recent meeting of the city council a communication was received from the Automatic Telephone Company reciting that it desired to sell its plant and franchise to the Independent Telephone Company; also, that its special deposit of $3,500 with the city be returned, and that the city council approve of the transfer. The Independent Company sent in a communication stating that under its franchise it had no power to encumber its plant financially, and made a petition to be empowered to purchase a plant instead of erecting one, as required by its franchise. Two ordinances were introduced later authorizing such acts.

MILWAUKEE, WIS.—It is reported that a wireless telegraph system is to be built between this city and Grand Haven, Mich., by the Cleveland and Buffalo steamship line.

MILWAUKEE, WIS.—All independent telephone companies in Wisconsin will hold a meeting at Lacrosse on June 26. The extension of competitive lines to Milwaukee will be considered.

LA CROSSE, WIS.—The Wisconsin Telephone Company's long distance line construction work between here and Eau Claire is rapidly progressing. The company will soon begin a long distance line from this city to Dubuque, Iowa.

WOODLAND, WIS.—The Eureka Telephone Company held its annual meeting at Neosho on May 25. President W. Wegwart and Vice-President J. A. Clason were re-elected. Secretary J. Mertis and Treasurer J. N. McCollow were new elections.

ELCHO, WIS.—The new rural telephone line between Elcho and Enterprise Lake, is proving a great success and will probably be extended considerably this year. The line already connects five large farms and passes through a rich agricultural district that is being rapidly developed.

MILWAUKEE, WIS.—The Milwaukee Citizens' Telephone Company has been incorporated with a capital stock of $25,000. The incorporators are J. W. Murphy, J. M. Clarke and P. J. Schmitt. The company proposes to build exchanges and lines in the State, and to eventually build an exchange in this city to compete with the Bell Company.

RACINE, WIS.—The Citizens' Telephone Company is now an absolute fact and giving service to its patrons. This company was organized by local citizens, there being upwards of four hundred of the most prominent business men as stockholders. The officers are: John B. Simmons, president; E. B. Belden, vice-president; J. C. Breese, secretary; C. R. Carpenter, treasurer, and William Van Middlesworth, general manager. The plant was constructed by Jones & Winter. The main portion of the outside construction is underground work and the service is full metallic. The exchange equipment, terminals, apparatus and telephones was furnished by the Sterling Electric Company, of Lafayette, Ind. The patrons began to receive service some thirty days ago, there being 700 connected up on the opening day. Remote residence districts and farmers' subscribers are cared for by the use of the Sterling selective signal non-interfering party line telephones, with four and eight subscribers upon one metallic circuit. It is fully expected before the close of the year that there will be fifteen hundred subscribers connected.

ELECTRIC LIGHT AND POWER.

ALAMEDA, CAL.—The Alameda municipal electric lighting system is being extended under the direction of Superintendent Weise.

SAN FRANCISCO, CAL.—The last installment of the machinery for the new electric hoist for the C. & C. shaft has arrived in Virginia City, Nev., and the entire electric installation will soon be in operation.

SAN FRANCISCO, CALIF.—The Consolidated California & Virginia mine, Virginia City, Nevada, is being made ready for the installation of the new electric hoisting plant, and most of the machinery has been received.

SAN FRANCISCO, CAL.—The electric hoist at the Yellow Jacket shaft on the Comstock Lode, Nevada, is in successful operation. Similar electric hoisting machinery is being installed at the Belcher and the C. & C. shafts.

SAN FRANCISCO, CAL.—The Renown Water and Power Company was recently incorporated in California, with Wilmington, Del., as the principal place of business. Directors, J. R. Newberry, J. R. Clark, L. W. Foster and L. W. Blinn. Capital stock, $500,000.

STOCKTON, CALIF.—The Mountain Water & Electric Company was recently incorporated, with Stockton as the principal place of business. Directors: J. U. Castle, L. A. Richards, J. P. Spooner, F. R. Clark and W. B. Harrison. Capital stock, $25,000; fully subscribed.

SAN FRANCISCO, CAL.—The Jupiter Light Company was recently incorporated, with Lemoore, Kings County, Cal., as the place of business. Directors, H. L. Jennings, G. Hutton, J. C. Moore, W. H. Battenfield and L. L. Johnson. Capital stock, $50.000; subscribed, $400.

SAN FRANCISCO, CAL.—The Bay Counties Power Company recently made a proposition to the authorities of San Quentin penitentiary, California, to save that institution $15,000 per year if granted the contract to furnish electric light and power for the prison and the jute mill operated by the convicts.

SAN FRANCISCO, CALIF.—The local electric light plant in Red Bluff, Calif., has been sold by James Cross to San Francisco capitalists. It is reported that the purchasers have closed a contract with the Shasta Electric Light & Power Company. Under this contract the local company will be able to supply adjoining localities with light and power.

SAN FRANCISCO, CAL.—The attention of the San Francisco Board of Supervisors has been called to the clause in the city lighting contract that stipulates that companies holding such contracts shall not require their employes to work more than eight hours a day. It is alleged that the San Francisco Gas and Electric Company and the Independent Electric Light and Power Company are violating the eight-hour clause.

SAN FRANCISCO, CAL.—The battleship Ohio, which was recently launched with great eclat in the presence of President McKinley and his Cabinet at the Union Iron Works, San Francisco, will be equipped with four 32-kw and four 500-kw, 80-volt, direct-connected generators, manufactured at the works. There will be in addition electric turret motors, ventilating fan motors and the usual apparatus installed in the latest war ships.

DENVER, COLO.—The Weston Electric Power Company has been incorporated to operate in Lake County. Capital, 50,000. Incorporators, W. P. Garrison, E. R. Reed and J. W. Sonhorn.

DENVER, COLO.—The Boulder Light and Power Company has filed articles of incorporation. The company was incorporated with a capital stock of $100,000. The directors are Charles B. Culbertson, president; Henry Casaday, vice-president; John H. Nicholson, treasurer; Charles C. Bromley, William H. Allison, Edwin J. Temple and Albert A. Reed.

SEAFORD, DEL.—A new water works system and electric light plant will soon be installed here, and bonds to the amount of $25,000 will be issued to pay for the same.

TOCCOA FALLS, GA.—The Toccoa Falls Electric Light & Power Company is completing an electric light system at Toccoa and lights will be turned on soon. The power is developed at Toccoa Falls, two miles distant. E. P. Simpson is in charge.

CHAMPAIGN, ILL.—The Lexington electric light plant has been sold to Lexington capitalists, headed by Mr. James Vandolah and A. H. Scrogin.

RICHMOND, IND.—Work on the new municipal electric light plant has begun. Instead of issuing bonds the Mayor borrowed the necessary money.

BLUFFTON, IND.—The electric headlight on the Clover-Leaf flyer prevented a bad wreck near this city. A cow was lying on the track asleep and the light enabled the engineer, who was running forty miles an hour, to see it in time to prevent a wreck.

FAIRMONT, IND.—Gilbert Larne sold his electric light plant to this city for $18,000 in payments of $150 per month. A new town board repudiated the contract and he sued to collect the money due him. The court not only ruled against him as to a judgment, but declared the contract void on account of exceeding the constitutional indebtedness allowed by cities. He then compromised by accepting $1,400, one-third of the amount due him, taking back his machinery and moving the plant off of the town property within ninety days. A new plant will be erected.

AUGUSTA, ME.—The Kennebunkport Light and Power Company, capital $10,000, has been incorporated. The officers are: President, Ernest P. Libby, of Sanford; treasurer, Andrew J. Robinson, of Sanford.

LANSING, MICH.—The East Jordan Electric Light and Power Company, East Jordan, has been incorporated with a capital of $10,000.

MINNEAPOLIS, MINN.—The Pipestone Electric Light, Heat and Power Company has been incorporated with a capital of $50,000. The incorporators are F. P. Wilson, D. J. McNerney and J. F. Conklin.

ST. LOUIS, MO.—The Board of Public Improvements has denied the application of the Laclede Power Company to pump water direct from the river into the power plant.

ST. LOUIS, MO.—It is reported that a new corporation, the Citizens' Electric Company, is organizing here with a capital stock of $3,000,000, to construct a generating plant and compete with existing electric light companies.

CHARLOTTE, N. C.—James E. Spencer, representing the New York Trust Company, has secured for about $18,000 the Rialto Mills property on the Appomattox River at Petersburg, Va. It is rumored that the Richmond, Va., Passenger & Power Company is interested.

CHATHAM, N. J.—At a borough election it was voted to issue $15,000 electric light bonds.

ALBANY, N. Y.—The Gas and Electric Company of Corning has been incorporated. Capital, $375,000. The directors are Ashley W. Cole, New York city; L. B. Grant, and N. L. Merry, Brooklyn.

ALBANY, N. Y.—The Syracuse Lighting Company, of Syracuse, has been incorporated with a capital stock of $2,500,000. The directors are Charles V. Nellany, of Brooklyn; Harry F. Cues, of Staten Island, and Richard F. McKinley, of New York city.

COXSACKIE, N. Y.—Certificates have been filed with the New York Secretary of State announcing the merger of the Coxsackie Electric Light Company and the Athens Electric Light & Power Company with the Upper Hudson Electric Company. The capital of each of the consolidating companies is $20,000.

ALBANY, N. Y.—The Upper Hudson Electric Company has been incorporated to furnish gas and electricity in towns and villages in Greene County. Capital $100,000. The directors are William O. Turner, of New York city; Eugene Wolfe, of Athens, and N. W. Dalton, of Bath.

NEWBURG, N. Y.—Having just six customers left, the Rhinebeck Gas Company was forced to go out of existence. For years the company did a thriving business, but with the installation of an electric plant a few months ago, electricity superseded gas, and the consumers gradually withdrew from the support of the company.

NORTH TONAWANDA, N. Y.—The Niagara Falls Light and Power Company has just finished a big change in its power service here. Heretofore the voltage furnished over the local lines was but 11,000; by the addition of three large cables, which run through from Niagara Falls to Buffalo, the voltage in the Tonawandas has been doubled, it now being 22,000. Many local mills and factories have already installed the electric power, and others are planning to follow suit in the near future.

CINCINNATI, OHIO.—The Traction Company will furnish power to light all the floats in the night pageants of the coming Fall Festival, which opens in this city Sept. 16 and continues until Sept. 28.

COLUMBUS, OHIO.—It is stated that the sinking fund trustees will probably purchase the $110,000 4 per cent thirty-year electric light bonds recently voted.

BOWLING GREEN, OHIO.—George Kerper, president of the Toledo, Bowling Green & Southern Railway Company, was here to find a suitable location for a power house.

DYERSBURG, TENN.—The citizens will hold a meeting to consider the advisability of issuing $50,000 in bonds with which to purchase the local light plant and water works.

HENDERSON, TEX.—A local company has been organized for the purpose of building an electric light plant. The capital has been paid in, and the contract for the machinery has been let.

AMHERST, WIS.—B. E. Dwinell & Co. have been granted a fifteen-year franchise by the village of Amherst to put in an electric light system.

THE ELECTRIC RAILWAY.

MOBILE, ALA.—A controlling interest in the Mobile Street Railway Company has been secured by a party of Atlanta and Mobile capitalists.

BIRMINGHAM, ALA.—The Birmingham Railway, Light and Power Company has, it is reported, been secured by Isadore Newman, of New Orleans, and others. While the report is not confirmed, it is said that large sums will be utilized in extensions and improvements, and that the new purchasers will assume control at an early date.

WASHINGTON, D. C.—Frederick D. H. Engley, a conductor on the Washington Traction Company's lines, and his brother, Samuel E. Engley, of Hyattsville, Md., whose arrest on charges of forgery revealed an alleged plot for flooding the city with bogus car tickets, has been held in $5,000 for the Grand Jury. Later a cablegram from the police authorities of Glasgow, Scotland, announced that they had recovered the plates from which the bogus tickets floated here were struck and also 40,000 sheets of tickets, aggregating 240,000 tickets.

DES MOINES, IA.—The Des Moines City Railway Company has filed a trust deed for $3,000,000 in favor of the Illinois Trust and Savings Company, of Chicago. This is an increase of $1,000,000 over the bond issue of $2,000,000 of May 1, 1893, in favor of the same company.

WORCESTER, MASS.—The directors of the Worcester Consolidated Street Railway Company have voted to increase the capital stock $1,675,000, for the purpose of covering the floating debt and paying for proposed extensions.

MUSKEGON, MICH.—Muskegon and Ludington are to be connected by an electric line, the Council of the former place having already granted a franchise.

LANSING, MICH.—The Lansing, St. Johns & St. Louis Electric Railway Company has filed a mortgage given to the Detroit Trust Company for $1,750,000 to secure an issue of bonds with which to provide the funds for purchasing the iron and equipping the road.

OMAHA, NEB.—Plans for consolidation of the street railways of Omaha and Council Bluffs, the electric power plants of the two cities and the Platte

River Canal appear to be assuming a definite shape, and it is said the consolidation now hinges only on terms of purchase. The new corporation is said to include the Omaha Street Railway Company, the Omaha & Council Bluffs Railway & Bridge Company, the Omaha Thomson-Houston Electric Light Company, the Council Bluffs Electric Light Company, the Omaha Water Company, the Council Bluffs Water Company, the Suburban Railway & Traction Company and the Platte River Power Canal. The new combination will probably be capitalized at $20,000,000.

GREENSBORO, N. C.—The Greensboro Electric Company has been granted a franchise by the town for the purpose of operating an electric street railway and furnishing electric lights and power to operate the water works. M. D. Barr, of New York, is interested.

AUGUSTA, S. C.—The Augusta & Aiken Railway Company, of North Augusta, has been commissioned to construct a 20-mile electric railway. Alfred S. Elliott, of Wilmington, Del., and others are the incorporators.

NEWARK, N. J.—The Essex Cross Railway, capital $500,000, has been incorporated to build a trolley line in Essex County. The incorporators are John A. Lawrence, Bloomfield; F. M. Eppley, West Orange; George A. Smith, Vailsburg; E. P. Alling, William Franklin, Charles Hathway, Robert Hawksworth, of East Orange.

JOHNSTOWN, N. Y.—The Fonda, Johnstown & Gloversville Railroad Company has voted to extend its electric road from Johnstown to Amsterdam.

UTICA, N. Y.—The Cleveland syndicate, which recently purchased the street railroad properties in this city, is reported to have bought the Herkimer, Mohawk, Ilion and Frankfort Street Railroad. The Utica road is expected to be built to Rome and Frankfort.

FAIRPORT, N. Y.—The Fairport Electric Railway Company has been incorporated with a capital of $110,000, to construct an electric road eleven miles long, between Fairport and Rochester. The directors include Charles A. Lux, Daniel E. Lux, of Clyde, and H. D. Brewster, of Syracuse.

BALLSTON, N. Y.—The stockholders of the Ballston Terminal Railroad Company have voted to increase the capital stock from $300,000 to $1,500,000, and consent is given to execute a mortgage for $1,200,000. The object of the extension of capital is to complete the road to the northern termini and fully equip it.

ALBANY, N. Y.—The Golden Bridge Electric Railway Company has been incorporated with a capital of $100,000, to construct an electric road between North Salem, Westchester County, N. Y., to Ridgebury, Conn. The directors are E. B. Brady, of Golden Bridge; F. W. Siebert, of Waterbury, Conn.; William H. J. Howe, of North Salem, and John Brophy, of Ridgefield, Conn.

WATERTOWN, N. Y.—Papers of incorporation of the Watertown & Carthage Traction Company have been filed here. The company is capitalized at $200,000. The directors and principal stockholders of the proposed company are: Arthur S. Fairchild, John W. Horner, Jr., New York; Ernest S. Emanuel, Brooklyn; J. T. Hollister, Rutherford, N. J.; Clyde Notman, Short Hills, N. J.; John N. Carlisle, F. M. Hugo, L. L. Luther and Mason N. Swan, Watertown.

CLEVELAND, OHIO.—The Masillon, Wooster & Mansfield Railway Company has been incorporated by T. K. Dissette, C. V. Hard, Frank W. Kirk, A. M. Parrish, and Robert C. Mitchell.

DAYTON, OHIO.—Valentine Winters, president of the Dayton & Western Traction Company, has secured consents of property owners for an extension of the road from Eaton to Richmond, Ind.

SHELBY, OHIO.—The Citizens' Street Railway Company, of Mansfield, which is building an extension from Mansfield to Shelby, is securing right of way to extend the line on to Plymouth, six miles north.

CLEVELAND, OHIO.—The Columbus, Delaware and Marion Railway Company has filed a trust deed for $1,000,000 in favor of the Western Reserve Trust Company, covering bonds issued for the building of the road.

RAVENNA, OHIO.—The County Commissioners have granted a twenty-five year franchise to J. A. Blackburn and George W. Taylor for an electric railway from Garrettsville to the Trumbull County line.

CLEVELAND, OHIO.—The directors of the Cleveland City Railway Company have decided to purchase new machinery to increase the capacity of the company's central power house. Plans for the extension are being prepared.

LANCASTER, OHIO.—The Columbus, Winchester & Lancaster Traction Company has been granted a franchise to build its line on the city streets. This completed the entire right of way for the road from Columbus to Lancaster.

COLUMBUS, OHIO.—General Axline, president of the Urbana, Mechanicsburg & Columbus Railway Company, states that his road will be built despite the steps taken for a rival road by the Columbus, London & Springfield Railway Company.

TIFFIN, OHIO.—The county commissioners have granted franchises to the Kerlin Brothers, of Toledo, and to the Toledo, Tiffin & Sandusky, rival companies, which propose building lines from this city to Fremont, Port Clinton and Sandusky.

CINCINNATI, OHIO.—Powell Crossley, president of the Cincinnati & Cleveland Railroad Company, has made application to the county commissioners for a franchise along the Springboro pike and the Dayton pike from Cincinnati to Dayton.

CLEVELAND, OHIO.—The Salem, Lisbon & East Liverpool Traction Company has been incorporated by H. W. Jones, E. N. Hait, Chas. H. Taylor, George H. Billman and H. H. Poppleton, all of this city. The temporary capital stock is $10,000.

CLEVELAND, OHIO.—The Cleveland, Elyria & Western Railway Company has secured all right of way and has decided on the route of its extension from Wellington to Ashland and Mansfield. The new line will be known as the Cleveland, Ashland & Southern Railway.

CLEVELAND, OHIO.—M. J. Mandelbaum, vice-president of the Southern Ohio Traction Company, has closed a deal for the purchase of the Hamilton and Lindenwald Electric Transit Company. The price is said to have been $225,000. The road runs through Hamilton to Lindenwald.

NORWALK, OHIO.—The Norwalk, Ashland & Southern Electric Railway Company has made application for a franchise to enter this city. The company has secured a private right of way from Norwalk to New London, Herford, Savannah and Ashland. The promoters are Ashland people.

COLUMBUS, OHIO.—The Board of Public Works has refused to allow the franchise of the Columbus, Delaware & Northern Railway on Summit and other streets, to be turned over to the Columbus, London & Springfield Railway Company, which is now in control of the former company.

MARIETTA, OHIO.—The Ohio River Bridge & Ferry Company has been incorporated by B. G. Davies, Harry B. Hoyt, Theron M. Ripley and others of this place to build a bridge and ferry across the Ohio River at this point and to operate an electric road across the same. Capital stock, $100,000.

CLEVELAND, OHIO.—The properties of the Cleveland and Chagrin Falls Railway Company and the Chagrin Falls and Eastern Railway Company passed into the hands of stockholders of the Cleveland and Eastern Railroad Company on May 25, and in the future the three roads will be conducted as one system.

CANTON, OHIO.—The Akron-Canton Railway Company has purchased a site for its power house near Berlin, a short distance from this city. It is stated that the company will also install equipment for illuminating purposes and will make a proposition to furnish lights in Canton and neighboring villages.

STEUBENVILLE, OHIO.—An application for a charter for the Steubenville, Mingoe and Ohio Valley Traction Company has been made in New Jersey, and the capital stock will be increased from $150,000 to $350,000. Extensive improvements will be made to the company's system, and the line will be extended to Brilliant.

KENTON, OHIO.—The county commissioners have granted the Findlay & Southern Electric Railroad Company a franchise for a road touching the county line near Foest, passing through Kenton and thence to the Union County line by way of Mt. Victory. It is stated that the road will be eventually extended from Columbus to Toledo.

TOLEDO, OHIO.—The Toledo, Fremont and Norwalk Railway has been appraised by the county auditor as follows: Rolling stock per mile, $550; tools, per mile, $30; main track per mile, $1,500; siding per mile, $500. The Toledo & Maumee Valley Railroad, which is an older road, was appraised as follows: Rolling stock per mile, $2,500; buildings, $3,000; tools per mile, $250; main track per mile, $3,750; siding per mile, $2,500.

CINCINNATI, OHIO.—Indications are that a large contract for the improvement of the lines of the Cincinnati Traction Company will be placed with the North American Construction Company, of Chicago. The improvements include the changing of the Sycamore cable line to electricity, the relaying of much track on other lines, and the construction of a number of extensions. About 34 miles of track will be laid and the contract will call for the expenditure of about $500,000.

YOUNGSTOWN, OHIO.—The Youngstown-Sharon Street Railway Company has awarded the contract for all the steel rails to be used in the construction of the line between Sharon and Newcastle, a distance of twenty-one miles. It is the intention to expend about $2,500,000 in Western Pennsylvania and Ohio on the new trolley system. The road, when completed, will connect Sharon and Cleveland, taking in intermediate points. New York and Chicago capitalists are furnishing most of the money to build the lines.

CINCINNATI, OHIO.—The Cincinnati & Northwestern Railroad Company (steam) which was recently acquired by the Southern Ohio Traction Company has made application to the council of College Hill to erect poles and string wires along its private right of way. This indicates that the upper end of the road will be operated by the Southern Ohio Company with both steam and electricity. Between Cumminsville and College Hill double tracks are being laid, one of which will be used for steam cars and the other for electric.

COLUMBUS, OHIO.—The Findlay & Marion Electric Railway Company has been incorporated by ex-Governor Jones and J. H. Ruhlman, of Youngstown; M. A. Smalley and C. E. Schwartzbaugh, of Toledo; Judge Smalley, of Upper Sandusky; Wm. E. Schofield, of Marion; P. B. Morrison, Hon. David Joy and Jason Blackford, of Findlay. The company has been organized with the above as directors and with the following officers: W. E. Schofield, president; A. W. Jones, vice-president; P. B. Morrison, treasurer and Jason Blackford, secretary. The temporary capital stock is $10,000.

CLEVELAND, OHIO.—The Southern Ohio Traction Company is projecting several feeder lines for its system in southern Ohio. Will Christy and M. J. Mandelbaum, of Cleveland, and F. J. Sloat, O. V. Parish and Peter Schwab, of Hamilton, directors of the Southern Ohio Company, have incorporated the Hamilton, Oxford & Western Electric Railway Company and the Cincinnati, Venice & Western Electric Railway Company. The former road will extend from Hamilton to Connorsville, Ind. The second line will extend from Cincinnati through northern Hamilton County and southern Butler county and will probably connect with the first mentioned road.

SANDWICH, ONT.—The Council for the township of Sandwich, West, Ont., has passed a by-law granting a franchise to run a line of the South Essex Electric Railway through the township.

CORNWALL, ONT.—The Electric Street Railway Company, of Cornwall, has purchased the property of the Cornwall Milling Company, and is fitting it up as a power house for the operation of its road.

ALLENTOWN, PA.—The Lehigh and Carbon Electric Railway Company, composed of Allentown and Easton capitalists, has secured the right of way for a twenty-mile trolley line from Allentown to Palmerton, Carbon County.

WILLIAMSPORT, PA.—A trolley line will be built between this city and Lock Haven, a distance of twenty-four miles. The line will pass through a populous farming community. Among the incorporators are State Senator J. Henry Cochran and ex-Attorney General H. C. McCormick, of this city, and Judge Charles Mayer, of Lock Haven. The company has been capitalized at $150,000. Senator Cochran has been elected president.

PENNSYLVANIA,—The Senate broke all local speed records last week, when it passed the bill amending the passenger railway act of 1889, to permit the construction of a passenger railway in any street not occupied at present and the bill providing for the erection of elevated and underground railways. These bills were introduced Wednesday, after it became known that P. A. B. Widener and William L. Elkins, the Philadelphia street railway magnates, had sailed for Europe. Representatives of the Philadelphia traction interests came here, and pleaded in vain either for the defeat of the measures or their postponement. The extraordinary speed at which they have been rushed through the Senate has aroused widespread interest. Ten minutes after their introduction they were reported favorably from committee, and they passed first, second and third readings without the loss of a moment's time, all amendments being rejected.

THE AUTOMOBILE.

THE NEWARK MOTOR VEHICLE COMPANY, of Newark, N. J., has been incorporated. Capital, $100,000. Incorporators: Frank K. Irving, Millard S. Muchmore and Henry C. Kees.

THE HIDLEY AUTOMOBILE COMPANY, of Troy, N. Y., has been incorporated. Capital, $50,000. Directors: Eugene Bryan, J. B. Holmes and N. R. Holmes, of Troy.

THE TRANSCONTINENTAL AUTOMOBILE RIDE.—Alexander B. Winton and Charles B. Shanks, who left San Francisco May 20 for New York, found the sandy deserts of Nevada insurmountable obstacles to their gasoline automobile and abandoned the expedition. Winton hopes to try it again in a horseless vehicle built for sand.

NEW YORK CITY.—An improvement in the stage service on Fifth Avenue is in sight, according to an announcement made by H. Sanderson, president of the New York Electric Vehicle Transportation Company. Automobile stages are to replace the horse vehicles as fast as they are procurable after Aug. 1 next, when the company is to begin running the electric stages over routes aggregating twenty-two miles, the whole system being an extension of the Fifth Avenue stage line. Twelve automobile stages capable of making ten miles an hour, exclusive of stops, are to be put in operation on Aug. 1, Mr. Sanderson said, and the number will be added to as fast as may be. The vehicles will be equipped with the new Exide batteries. The new stages are to seat thirty-four passengers and are to be built with room enough in the aisle for persons to walk between the two rows of seated passengers high enough inside for a six-foot man to walk upright in a silk hat.

NEW INDUSTRIAL COMPANIES.

THE PENNSYLVANIA ELECTRIC VEHICLE COMPANY, of Carlisle, Pa., has been incorporated at Wilmington, Del., with a capital of $2,500,000.

JEFFERSON CITY, MO.—Evidence of incorporation was filed by the Western Electric Company, of Illinois, on June 1. Capital stock, $8,000,000; capital in Missouri, $100,000. Gerard Swope, of St. Louis, represents the company in Missouri.

ST. LOUIS, MO.—Articles of incorporation have been filed by the National Power Company, which will manufacture power-producing machinery. The capital stock is $30,000, held by John Ott, Christian Neuman, Charles Kroemecke, Geo. M. Hillenbrand and Geo. Weinheimer.

GARL ELECTRIC COMPANY, Akron, Ohio, has but recently incorporated, and T. H. Lyder, secretary and treasurer, writes us that the organization is not yet quite completed. Within the past few days it has moved into new and very commodious quarters, and is rapidly putting things in shape for early production on a large scale of its well-known telephone apparatus, etc.

LEGAL.

ELECTRIC VEHICLE & TRANSPORTATION.—An order has just been signed, returnable next Tuesday, directing the officers of the New York Electric Vehicle & Transportation Company to show cause why they should not be enjoined from enforcing the $10 assessment made upon the stock of that company. The action has been moved by a Mr. Benjamin Meyer.

CROSSING TROLLEY TRACKS.—A warning to those who have occasion to drive over suburban electric railroad tracks is contained in a decision rendered by Judge Stockbridge in Baltimore. In giving judgment for a railroad company, in an action against the company to recover for damages done by one of its cars striking a carriage, the Judge found that there was contributory negligence on the part of the driver of the carriage in attempting to cross the tracks. He held that there is a distinction between the degrees of care to be exercised in the operation of electric cars in the populous portions of the city and in sparsely settled sections, such as that where the accident occurred. As the car was running on a private right-of-way and the tracks are built as are those of steam railroads, the rule applicable to the case is similar to that governing the crossing of steam railroad tracks. Before crossing such tracks, the one who wishes to have a valid claim for damages must "stop, look, and listen."

PERSONAL.

MR. HARRY TUCKER CRISSEY, secretary of the E. G. Bernard Company, Troy, N. Y., was married June 4 to Miss Josephine Austin Bacon, of Loudenville, N. Y.

MR. ARTHUR V. ABBOTT, chief engineer of the Chicago Telephone Company, lectured recently before the Armour Institute of Technology, of Chicago, on wireless telegraphy.

MR. JAMES BURKE, electrical engineer of the Bergmann Elektricatats Werke (formerly of Herrick & Burke, New York), arrived last week on the "Deutschland" for a short visit in the United States.

MR. S. P. GRACE, of the engineering staff of the Erie Telephone system, with headquarters at Detroit, delivered a course of lectures on telephone engineering recently before the engineering department of the University of Michigan.

MR. WM. POWELL MASON, prominent in Boston financial and business circles, died recently in Vienna. He was a director of the Merchants' National Bank, the Edison Electric Illuminating Company and a number of cotton manufacturing companies.

MR. EMERSON McMILLIN, the banker of this city, who formerly lived in Columbus, Ohio, and has long been actively interested in electrical properties, has promised to defray the expenses of a week in the country for a thousand poor children of Columbus and other towns embraced in the Columbus district of the Epworth League.

MR. A. J. MACDONALD, of Montreal, has just been appointed general superintendent of the street railway system of the City of Mexico. Mr. Macdonald, who is about thirty years of age, is at present in charge of the centre division of the Montreal Street Railway system, in the employment of which he began as a conductor.

MR. FRED SCHOENENBERGER, superintendent of the electrical department of the Oerlikon Works, Switzerland, sailed for Europe this week, after a visit of several months in this country. During part of his stay Mr. Schoenenberger was at the Bullock works at Norwood in connection with the arrangement whereby the American firm will have the benefit of the designing department of the Oerlikon works.

JUDGE JAMES M. THOMAS, president of the Independent Telephone Association of the United States, general manager of the United States Telephone Company, and one of the leading figures in the independent field, has, according to a press despatch, been offered the presidency of the Knickerbocker Telephone Company and the Telephone, Telegraph & Cable Company, of New York, which were recently formed with a capitalization of $55,000,000 by the consolidation of independent interests in New York. The companies are building exchanges in New York and Boston. The proposition made Judge Thomas is a most flattering one, but whether or not he will accept has not yet been decided. Judge Thomas has recently spent considerable time in New York, assisting in the formation of the companies.

MR. T. A. EDISON has lately predicted a general adoption of the plan of building houses with "poured" cement, of which he is producing large quantities at his crushing plants. The New York *Times* says: "Mr. Edison's forecast of cheap houses built of cement and rubble by means of boxes, into which tier after tier is 'poured' and allowed to harden, is somewhat fantastical. The method is an old one, and it has been tried with success in certain climates, but there is no proof that it is suited to a land like ours, where heavy rains disintegrate such walls in summer and snowfalls alternate with thaws in the winter. Our architects have already introduced a modification of this style for country houses, consisting of wire lathing covered with plaster. This leaves an air chamber in the thickness of the wall and prevents 'sweating,' and, while much cheaper, is much warmer. Whether it will be as durable as solid walls remains to be seen. A combination of steel structure and solid concrete is another thing. That is merely a modification of iron architecture. After all, the economic question remains. Can such walls be made durable and capable of supporting the weight of several stories, and at the same time cheaper than wood and stone? The cost of materials and the cost of labor are at present greater for buildings of this kind. Simple four-square buildings of one story and attic might be cheap, but a villa of any complexity introduces so many elements that the cost increases unduly."

Trade Notes.

OIL FILTERS.—Four Cross oil filters are installed in the power house at the Pan-American by the Burt Manufacturing Company, of Akron, Ohio.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has removed its Cleveland, Ohio, office to larger quarters in the New England Building, from No. 1310 in that building to 1007. Mr. C. S. Powell is in charge of the Cleveland territory.

THE WESTON ELECTRICAL INSTRUMENT COMPANY announces the removal of its office and works to its new manufacturing plant at Waverly Park, N. J. The nearest telegraph office is Newark, N. J., and telegrams addressed to the company at Waverly Park are received at Newark and forwarded by telephone.

A POCKET CALCULATOR.—An aluminum pocket calculator is being marketed by C. Francis Jenkins, 1325 F Street, N. W., Washington, D. C., at a very low price—35 cents. The instrument is made of frosted aluminum in two parts, a back piece and a revolvable disk. The back and the disk are marked with identical scales, the scale on the disk just inside the other. The whole is about as thick as two visiting cards, and of a size readily carried in the vest pocket.

THE MAXWELL M. MEYER ELECTRIC COMPANY, 2369 Second Avenue, New York, has issued Bulletins No. 10 and 11, one being entitled, "Direct-Current Motors and Dynamos," and the other "Dynamos for Plating and Electrolytic Processes." Recent shipments of motors and dynamos have been made to Calcutta, India; Rangoon, British Burmah; Forest Hill, Conn.; Newark, N. J., and Valley Field, Canada. Among recent sales in New York City are motors or dynamos to the Eagle Iron Works, Ceylon Coffee Company, General Electric Water Company and Hotel Kennesaw.

DURHAM TELEPHONES.—The Durham Telephone Manufacturing Company, Durham, N. C., describes and illustrates its complete line of telephone apparatus in a forty-eight-page pamphlet of recent issue.

WILLYOUNG INSTRUMENTS.—Elmer G. Willyoung, 11 Frankfort Street, New York, is mailing to the trade a list of his catalogues. The different classes of instruments manufactured by him are also mentioned.

FALCON ARC LAMPS.—The Falcon Electric Manufacturing Company, 432 East Seventy-first Street, New York,, has issued a card illustrating its plain direct-current arc lamps. The principal features of the lamps are pointed out.

HOLOPHANE GLASS.—The Holophane Glass Company, 15 East Thirty-second Street, New York, in a recently issued catalogue describes and illustrates Holophane glass globes, which are extensively used in electric lighting.

SEAMLESS TUBING.—The Benedict & Burnham Manufacturing Company, in a pamphlet of recent issue, describes the properties and uses of "Benedict-Nickel" seamless tubing, which is one of the products of this well known company.

TO BANISH WORRY.—Mr. Stephen L. Coles, of the Shaughnessy Agency, 5 Beekman Street, New York, has an excellent recipe for relieving business men of part of their worry. On a card just issued he points out how this can be done.

FUSE WIRE.—The lines of tested fuse wire and links manufactured by the Chicago Fuse Wire & Manufacturing Company, Chicago, are listed in Catalogue No. 12, issued by the company. The catalogue has been prepared with great care, with the idea to facilitate ordering, particularly where special sizes are required.

UNDERWRITERS' APPROVAL.—Mr. Harvey Hubbell, Bridgeport, Conn., informs us that the Underwriters' laboratory of Chicago has approved of his pendant chain pull socket. This action places the device in the category of standard approved goods. This pendant pull socket was described and illustrated in this column March 30, 1901.

THE CENTURY MOTOR VEHICLE COMPANY announces that its works are now running smoothly and on full time. Only a few of its men went out in the machinist's strike, but, the company informs us, they have all returned to work and its factory is now running full-handed in all departments. It is now able to fill its orders with reasonable promptness.

SPEED REGULATION OF WATER POWER PLANTS.—We have received from Mr. Allan V. Garratt, chief engineer of the Lombard Water-Wheel Governor Company, Boston, Mass., a copy of a pamphlet containing a reprint of an article from *Cassier's Magazine*, entitled "Speed Regulation of Water Power Plants, the Practical Side of the Problem." The subject is very fully considered.

BOILER CLEANER.—The Ford automatic boiler cleaner is described and illustrated in a pamphlet recently brought out by the Ford Automatic Boiler Cleaner Company, Carleton Building, St. Louis, Mo. Besides describing the operation of this device, the pamphlet contains a good deal of general engineering information, and fac similes of many testimonial letters telling of the satisfaction given by these cleaners.

THE AMERICAN BATTERY COMPANY, 172 South Clinton Street, Chicago, states that it has equipped 218 central energy telephone exchanges with its storage cells. It will have a battery in operation at the Buffalo Exposition, being part of the power equipment of the American Electric Telephone Company's exhibit. Its June 1st catalogue and revised price list of cells is now ready for distribution.

FAN TESTS.—The Emerson Electric Manufacturing Company is sending out a circular, showing the result of tests recently made by the company on various makes of alternating-current desk fans. Two illustrations are given, one showing the actual velocity of wind, not taking current consumption into consideration, and the other showing comparative efficiencies when taking current consumption into consideration.

LIGHTNING ARRESTERS.—The Garton-Daniels Company, Keokuk, Ia., has issued two neat pamphlets. One illustrates the various types of Garton lightning arresters for use on electric railways, light and power circuits, either alternating or direct currents; the other is a story of the experience of a certain street railway company in Chicago with Garton arresters. Street railway managers should read this story, as it contains some interesting facts.

FORT WAYNE APPARATUS.—The Fort Wayne Electric Works recently issued three illustrated bulletins, describing "Wood" measuring instruments; "Wood" open series arc lamps, shunt type, for direct constant current circuits, and the "Wood" constant current dynamos, for arc lighting, with improved regulator. Other recent publications of the same company are pamphlets on "Wood" primary fuse boxes, and the "Wood" cut-out for arc circuits.

PUMPING MACHINERY.—The Jeanesville Iron Works Company, Jeanesville, Pa., describes its new line of pumping machinery in Advance Sheets No. 10 and 11, just issued. The Jeanesville triplex electric pump is illustrated and the principal features described; diagrammatic illustrations show its construction. A large modern mine pumping engine is described and illustrated in Sheet 11. Those interested in this line of apparatus can secure a copy of the sheets on application.

THE GOULD STORAGE BATTERY.—At the recent conversazione of the American Institute of Electrical Engineers, the Gould storage battery exhibit excited considerable interest, chiefly on account of the method of manufacturing the plates, which method gives a much increased active surface. This battery is fully described and well illustrated in a catalogue just issued by the Gould Storage Battery Company, Depew, N. Y. Tables give the dimensions, capacities, etc., of the cells of various sizes.

HYDRAULIC JACKS constitute the subject of a very complete catalogue (No. 61) recently issued by the Watson-Stillman Company, 204 East Forty-third Street, New York. This is a new edition of old catalogue No. 54, and contains new sizes of jacks. Jacks for a great variety of uses are illustrated and briefly described. The Watson-Stillman Company has been making hydraulic jacks for fifty years, and this fact alone is a testimonial far more impressive than any number of testimonial letters could be.

APPLICATIONS OF TELEPHERAGE.—The United Telepherage Company is rapidly introducing its telepherage system throughout the country. In two illustrated circulars of recent issue examples of practical applications of the system are shown. In one case the automatic electric conveyor system in operation at the works of the Yale & Towne Manufacturing Company, Stamford, Conn., is described and illustrated, and in the other the subject is the telepherage system in operation in a glass works in St. Louis.

FANS.—The advent of the fan season is heralded by the catalogues of manufacturers. The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued an artistically designed catalogue of its 1901 fan motors and ceiling fans for alternating current. The various styles are illustrated by means of excellent half-tone cuts, and the features of each are comprehensively set forth. A telegraph code is given at the back, which will facilitate ordering by telegraph.

POWER DEVELOPMENT CONTRACTS.—Work has been begun upon the Cape Fear power plant at Buckhorn Falls, N. C. The contract for the electrical equipment has been awarded to the General Electric Company and for turbines to the S. Morgan Smith Company, of York, Pa. The contract for the insulation has been awarded to the R. Thomas & Sons Company, East Liverpool, Ohio, and for the transmission lines, which will be 36 miles long, to Mr. John Blair MacAfee, of Philadelphia. Messrs. W. A. Smethurst and Rodney D. Allen will be the engineers representing Mr. MacAfee in the construction of the transmission line.

GRAPHITE PRODUCTIONS.—In an artificially designed pamphlet, just issued, the Joseph Dixon Crucible Company, Jersey City, N. J., gives an interesting description of its graphite productions. The two centre pages show the company's plants; the graphite works at Ticonderoga and the main plants at Jersey City. Views of the graphite mines and cedar mills are also shown. The various graphite articles manufactured by the company, a great variety of pencils, and packages of graphite for different purposes are also illustrated. The front cover of the catalogue is an artistic piece of designing and printing, and shows a masterly handling of *chiaroscuro*.

Record of Electrical Patents

UNITED STATES PATENTS, ISSUED JUNE 4, 1901.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

675,373. GRADUATED RESISTANCE COIL; F. Comminge, Pittsburg, Pa. App. filed March 29, 1901. One or more cylindrical layers of insulating material, each wound around with resistance wire, the terminals of the wire leading to the rheostat contacts.

675,377. SIGNALING DEVICE FOR TELEPHONE SWITCHBOARDS; H. C. Dodge, Cleveland, Ohio. App. filed Dec. 21, 1900. The drop is mechanically restored to its normal position by the plug as it enters the jack.

675,380. PRINTING TELEGRAPH; R. A. Fowden, Philadelphia, Pa. App. filed Nov. 2, 1899. These improvements relate to the various features of a printing telegraph outfit.

675,383. AUTOMATIC ELECTRIC CUT OUT; F. D. Greenstreet, Holborn, and E. J. Selby, Birmingham, Eng. App. filed June 12, 1900. A fusible wire passes through the center of two carbons in line with each other and in contact at their meeting ends; when the wire is fused, springs throw the carbons out of line, thus entirely covering the circuit.

675,398. ADJUSTABLE PROTECTING DEVICE FOR ELECTRIC LAMPS; E. J. McAllister, A. D. Page and L. C. Werner, Newark, N. J. App. filed Feb. 28, 1901. A sheet-metal guard is clamped around the socket and rests in contact with the lamp just above the neck.

675,413. PROCESS OF COATING FIBROUS MATERIAL WITH METAL; J. H. Robertson, Brooklyn, N. Y. App. filed Jan. 6, 1900. (See Current News and Notes.)

675,419. GALVANIC BATTERY CELL; C. T. Sittig, Gross-Lichterfelde, Germany. App. filed May 11, 1899. (Cee Current News and Notes.)

675,427. ELECTRIC HEATER FOR ELECTRIC GLOWER LAMPS; J. Van Vleck and W. N. Stevens, New York, N. Y. App. filed April 27, 1900. (See Current News and Notes.)

675,455. PROCESS OF MANUFACTURING LEAD SALTS BY ELECTROLYSIS; J. B. Tibbits, Hoosick, N. Y. App. filed March 6, 1894. (See Current News and Notes.)

675,459. APPARATUS FOR THE ELECTROLYTIC PRODUCTION OF PIGMENTS; J. A. Yunck, Hoosick, N. Y. App. filed Dec. 16, 1898. (See page 1014.)

675,460. PROCESS OF MANUFACTURING WHITE LEAD BY ELECTROLYSIS; J. A. Yunck, Hoosick, N. Y. App. filed Feb. 25, 1899. (See page 1014.)

675,467. TELEPHONE SPEAKING TUBE OR LIKE RECEIVER; H. A. Cutmore, Lee, England. App. filed March 31, 1900. A flexible structure for attachment to the instrument to exclude outside sound from the ear.

675,495. WRITING TELEGRAPH; A. Pollak and J. Virag, Budapest, Austria-Hungary. App. filed June 28, 1900. The method of telegraphicaHy

controlling a writing receiver adapted to trace a continuous line, which consists in mechanically imposing upon the circuit for each character of the message to be transmitted a definite and predetermined number of current impulses adapted to actuate said receiver to trace the message in script characters.

675,496. WRITING TELEGRAPH; A. Pollak and J. Virag, Budapest, Austria-Hungary. App. filed June 28, 1900. This patent contains apparatus claims for carrying out the method described in the previous patent.

675,517. CONTROLLER FOR ELECTRIC MOTORS; F. A. Merrick and E. W. Stull, Johnstown, Pa. App. filed Aug. 28, 1900. In a car controller the handle of the regulator switch is connected with the reverse switch in such a way that by special movement of the handle, the reverse switch is unlocked.

675,518. ARMATURE VENTILATION; F. A. Merrick, Johnstown, Pa. App. filed Oct. 25, 1900. Relates to the shape of a spacing block inserted between the plates.

675,522. TROLLEY POLE; C. Nicholson, Springfield, Mass. App. filed Sept. 5, 1900. A pole in telescoping sections with automatic devices for opening and closing it.

675,527. MAGNETIC BRUSH; J. B. Righter, Elroy, Wis. App. filed Sept. 12, 1900. Magnetic pins representing the bristles are attached to magnetic plates in the back of the brush.

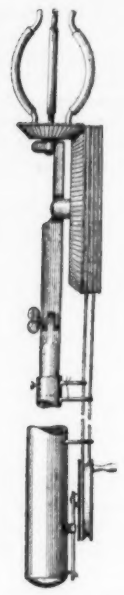
675,532. SYSTEM OF ELECTRICAL DISTRIBUTION; L. B. Stillwell, New York, N. Y. App. filed Feb. 14, 1901. (See Current News and Notes.)

675,555. ELECTROLYTIC PRODUCTION OF WHITE LEAD; E. D. Chaplin, Winchester, Mass., and H. G. Halloran, Boston, Mass. App. filed July 5, 1900. (See Current News and Notes.)

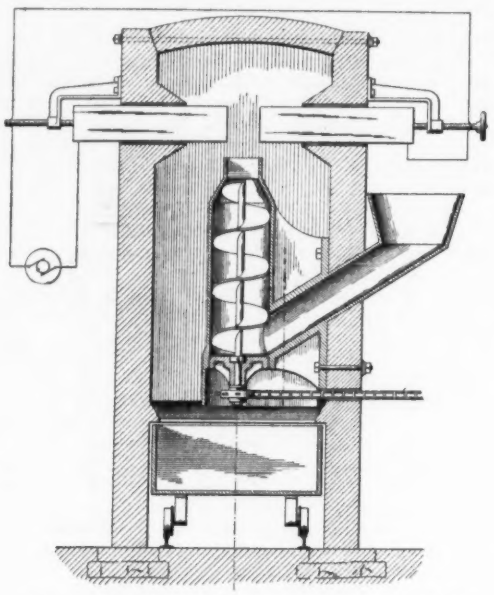
675,586. ELECTRICAL STORAGE BATTERY; W. J. Buckley, Chicago, Ill. App. filed July 5, 1900. (See Current News and Notes.)

675,587. SECONDARY BATTERY; W. J. Buckley, Chicago, Ill. App. filed Feb. 2, 1900. (See Current News and Notes.)

675,588. STORAGE BATTERY; W. J. Buckley, Chicago, Ill. App. filed Oct. 9, 1899. (See Current News and Notes.)



675,640.—Apparatus for Removing Electric Light Bulbs.



675,646.—Process of Producing Calcium Carbid.

675,599. ELECTRIC ARC LAMP; D. Higham, Winthrop Highlands, Mass. App. filed Nov. 21, 1900. In connection with a series coil and an auxiliary coil means are provided for causing the magnetomotive force of the latter coil to vary at a rate different from the rate of variation of current in the arc.

675,600. STORAGE BATTERY; G. W. Hough, Evanston, Ill. App. filed Dec. 20, 1900. (See Current News and Notes.)

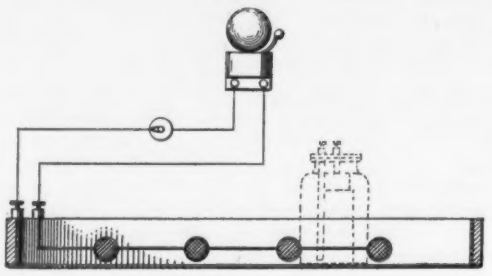
675,614. ELECTRIC SWITCH; J. M. Anderson, Boston, Mass. App. filed Jan. 17, 1900. A form of quick acting switch.

675,615. INSULATOR; J. M. Anderson and A. Anderson, Boston, Mass. App. filed Jan. 31, 1901. Details of an insulator for supporting a rail.

675,636. ROTARY POLISHING MACHINE; J. McCahey, Providence, R. I. App. filed April 4, 1901. In a polishing machine the combination of two sets of polishing devices running in opposite directions and arranged to operate at the same time on a cable, with a space between the sets to allow a dressing to be applied to the cable after being partly polished and before finishing.

675,640. APPARATUS FOR REMOVING ELECTRIC LIGHT BULBS; F. H. Renard, Wilkesbarre, Pa. App. filed Jan. 2, 1901. A rod on the end of which is gearing and a grip adapted to take hold of the lamp bulb; the bulb can thus be rotated to remove it from the socket by means of a belt extending from the gearing to a pulley near the handle.

675,646. PROCESS OF PRODUCING CALCIUM CARBID; J. Zimmerman and I. S. Prenner, Chicago, Ill. App. filed March 13, 1899. A feature of the invention is the provision for feeding the mixture through the furnace from below, so that as it is fed to the arc it completely fills the space and utilizes the entire heat of the arc.



675,708.—Battery Tray.

675,653. ELECTRIC BELL MECHA..ISM; W. E. Foster, Carnegie, Pa. App. filed Dec. 8, 1899. The hammer is lifted from the gong by a solenoid and is carried against it by gravity, means being provided for lifting the hammer slightly away from the gong after it has struck it.

675,662. RETAINING LOOP FOR PLATING RACKS; S. Lowe, Waterbury, Conn. App. filed Nov. 15, 1900. A wire rack for the support of articles while being electro-plated.

675,667. ELECTRIC BRAKE FOR RAILWAY CARS; F. C. Newell, Wilkinsburg, Pa. App. filed March 26, 1900. A brake switch adapted to connect the motor or motors to act as generators in a local braking circuit regardless of the position of the handle of the running controller.

675,668. ELECTRIC BRAKE; F. C. Newell, Wilkinsburg, Pa. App. filed April 28, 1900. A modification of the preceding patent.

675,675. ARMATURE AND MAGNET ADJUSTING DEVICE FOR RELAYS OR OTHER ELECTRIC INSTRUMENTS; U. S. Rogers, New York, N. Y. App. filed March 5, 1901. Details.

675,685. EXTENSION BELL FOR TELEPHONES; V. J. Van Horn, Keokuk, Iowa. App. filed April 12, 1900. The bell or signal on the extension line is operated by a mechanical action of the main signal bell.

675,690. CONTACT PLUG; C. Wagner, New York, N. Y. App. filed Feb. 28, 1901. Details.

675,708. BATTERY TRAY; J. R. Blackwell, New York, N. Y. App. filed Feb. 15, 1901. The tray contains electrodes connected in an alarm circuit, so that in case a cell resting in the tray becomes broken, the solution will act upon the electrodes in the tray and send in an alarm.

675,738. COMBINATION WATER-TIGHT JUNCTION BOX, RECEPTACLE, AND FIXTURE; A. E. Jahl, New York, N. Y. App. filed March 9, 1901. Details.

675,749. ELECTROLYTIC CELL; A. Merry, Liscard, Eng., and J. H. Noble, Liverpool, Eng. App. filed Nov. 19, 1900. (See Current News and Notes.)

675,755. APPARATUS FOR INDICATING THE PRESENCE OF DANGEROUS GASES; H. G. Prested, London, Eng. App. filed Oct. 15, 1900. A porous vessel exposed to the dangerous gases allows passage of the gas inward more rapidly than passage outward of the air contained in the vessel, as the gas and air tend to diffuse, and thus a flexible diaphragm closing a passage from the vessel becomes more or less bulged and makes an electrical contact whereby an alarm is operated.

675,784. SECONDARY BATTERY; C. L. R. E. Menges, The Hague, Netherlands. App. filed Dec. 23, 1897. (See Current News and Notes.)

675,846. MOTOR; A. Benson, Chicago, Ill. App. filed Nov. 4, 1899. The object is to provide means whereby an electric motor may be utilized for starting an engine, and the latter utilized for driving the motor as a dynamo and storing electricity for use in either starting the engine or assisting the latter in the work it has to do.

675,847. MOTOR; A. Benson, Chicago, Ill. App. filed Nov. 4, 1899. A modification of the preceding patent.

675,848. MOTOR; A. Benson, Chicago, Ill. App. filed Jan. 31, 1901. An explosive engine for automobiles adapted to be started in either direction or stopped and reversed without turning the crank shaft by hand and as readily and with the same degree of certainty as can be done with a steam engine.

675,865. AUTOMATIC CIRCUIT BREAKER; C. E. Starr, Camden, N. J. App. filed Nov. 22, 1899. A circuit breaker, consisting of a box having an open side, contact devices mounted therein, a lid adapted to close the open side of said box and hinged at one edge to one side thereof, said lid forming the switch-carrying arm of the circuit breaker, tension devices situated within said box and bearing against the inner face of said lid, and locking devices for said arm adapted to be actuated by an abnormal current in the line to release said lid.

675,871. SAFETY ALARM DEVICE; L. Da Rozir, Boston, Mass. App. filed April 23, 1900. A weight carried by an arm is removably attached to a shaft in such a manner that centrifugal action will cause the weight to close a circuit.

11,913. (Re-issue.) TRANSMITTING ELECTRICAL IMPULSES AND SIGNALS AND APPARATUS THEREFOR; G. Marconi, London, Eng. App. filed April 1, 1901. (See page 1022.)

INDEPENDENT TELEPHONE CONVENTION

THE Independent Telephone Association of America held its fifth annual convention at Buffalo, N. Y., on June 11, 12 and 13. The headquarters were established at the Iroquois Hotel, and the meetings were held at the Convention Hall, about a mile distant. The attendance was in all probability the largest that has ever graced a telephone convention in America; at any rate, one would have to go back to the earliest years of the industry, around 1880, to find a meeting that would approach it for numbers and enthusiasm. A list of those in attendance appears elsewhere.

At noon the convention was called to order by Judge J. M. Thomas, president, who introduced Mr. Conrad Diehl, Mayor of Buffalo. Mr. Diehl made a brief and pithy address of welcome, greeting the delegates not merely on the ground that they had come as a body to the Pan-American city, but because they represented a principle of vast importance in all industries, viz., "competition is the life of trade." From the competition which they offered in their line it was only reasonable to suppose that the public would be the beneficiaries. Certainly the telephone was almost as necessary now as the air we breathe and the food we live on. In the all-important matters of sickness the telephone in forbidding delay showed its value, and so in all other directions. Out of their efforts, therefore, and from the competition created, must come, he hoped, a betterment in price and a betterment in service. As to the Pan-American Exposition, which was doubtless one of the reasons for their presence, he might point to it as a striking illustration of what they were interested in—the modern uses of electricity, all of which were exemplified. Buffalo itself was worth study in its elevators, lighting, street cars and even its telephones, all deriving the power for their operation from the distant cataract at Niagara Falls.

PRESIDENT'S ADDRESS.

Judge Thomas then delivered his presidential address, essentially as follows:

The past year has been one fraught with important events in the telephone world, and the great work that has been accomplished is the highest commendation that can be offered to the great army of workers in the field. Having been in close touch with all the great independent organizations of the country and knowing their present status, I do not hesitate to say that all doubt of the permanency of the independent telephone movement has passed. Doubters have become its advocates, while the voice of the false prophet is no longer heard in the land, and his writings have been placed in the archives of oblivion bearing the inscription above its portals, "Failure."

The work in the Middle West, North and South, the greatest fields of activity in telephone development, is to be followed by very active development in the extreme Eastern and Western sections of the United States, and in a short time the organizations, now nearing perfection in these sections, will show a development that will be highly gratifying to those of us who for several years have labored in the fields now more fully developed.

In speaking of the conventions held by this organization I have heard several gentlemen who have attended them say that the general tone resembles more political conventions than conventions of allied business interests. I have always agreed with that statement with a limitation that they have been somewhat like political conventions would be with the politics eliminated. Like public conventions, we have never lost sight of the principles of progress and fair dealing with the people, and being so different from meetings of the men who control the Bell companies, this impression has found lodgment in some minds. But this spirit, being the surest sign of the fundamental principles of progress, we desire that it shall always be the keynote of all conventions of the organization.

There has been much inquiry, not only on the part of those who have control of this field of investment, but also by those desiring to enter, as to the underlying principles that actuate the development of this movement. To fully and properly answer that inquiry requires a careful study of the entire history of telephony and would require more time than those of us who are actually engaged in construction and operation have been able to give to the subject; but a glance over certain events and certain policies will be of interest and profit to persons seeking the knowledge desired by the prudent man before investing in the building of telephone properties.

The telephone being one of the greatest utilities discovered and put into practical use by man, and being entirely new, and the only means of reproducing articulate speech at a distant point, gave the inventors a right to protection for seventeen years under the United States statutes, which rights the inventors could keep or sell to others if they so desired.

Bell's invention, the first put into practical use, and which at one time was a useful and satisfactory transmitter, being what we generally term a magneto telephone, gave place to a more effective instrument, the product of the minds of several inventors but brought into perfection by that great inventor, Thomas A. Edison, who discovered the fact that carbon electrodes held in constant contact but so arranged as to admit of variable pressure in conformity with sound waves, the result of articulate speech, thus regulating the flow of an electric current through them produced by a battery in connection therewith, gave a fuller and more perfect transmitter than Bell's invention.

After this discovery Bell's invention was fast supplanted as a transmitter by the more effective microphone, but its use as a receiver in connection with the microphone has been universal. For the purposes of this investigation the great volumes of records and briefs in litigation between inventors, or their assigns, will be of very little service, and, therefore, we pass to such facts as will enable us to more fully understand the history leading up to the beginning of the independent telephone movement.

The first, or fundamental, Bell patent expired in March, 1893, and the second Bell or magneto telephone patent expired in January, 1894, and between these dates we find the work of establishing independent systems began. Nov. 17, 1891, the Berliner patent was issued on an application filed June 4, 1877. The claims of this patent were intended to be broad enough to cover all constant-contact battery transmitters, and these were believed to be all battery transmitters of commercial value.

In May, 1893, the Edison carbon transmitter patent was issued on an application also filed in the year 1877, and it should be remembered that both the Berliner and Edison patents were owned by the American Bell Telephone Company. This patent was for the use of carbon electrodes in a battery transmitter. No other material has been found as a practical substitute for carbon.

These two patents were for seventeen years from the date of their issue, and if either or both of them had been found valid it would have continued the Bell Telephone monopoly to the year 1908 or 1910.

When the Berliner patent was issued, Milo G. Kellogg obtained a certified copy of the record of the application in the Patent Office, and after a careful study of the same for several months, became convinced that the patent was invalid for several reasons, and would

not be sustained by the courts, if intelligently litigated. He also realized that unless its validity was attacked in some unusual manner it would remain as a menace to prevent any extensive competing use of battery transmitters, and when it came to be litigated, if such a case should arise, the defense was likely to be weak and ineffective, and the patent, therefore, likely to be sustained, and thus the Bell monopoly would continue to the end of the term of the patent. He then conceived the idea that the question was one of great public importance, and that the patent, having, as he believed, been improperly granted, the Government itself should begin a suit to test its validity, on the basis of annulling or revoking it. It was certain that a patent could be revoked on the ground of fraud, but it had not been adjudicated whether a patent could be revoked on grounds of invalidity. The proper channel for bringing a suit to annul or revoke a patent was through the Attorney General in the name of the United States against the party or his assigns claiming the right of monopoly under the patent.

He prepared a brief of about 150 pages, giving the various grounds on which he believed the patent was invalid, and in November, 1892, presented the same to the Attorney General. After the matter had been considered, and with the approval of President Harrison, a bill was filed by the Attorney General in 1893, in the name of the United States against the American Bell Telephone Company. The first decision in the case was by Judge Carpenter, who declared the patent invalid for two reasons, but did not pass on the other grounds of invalidity which were raised. These two reasons were, first, fraud in obtaining the patent, and, second, the fact that a patent had been granted to Berliner on the same invention in the year 1880. The case was carried to the United States Circuit Court of Appeals, which held that the only ground on which the patent could be canceled or annulled was that of fraud, and that the other claims of the bill could only be set up as defense in a suit brought by the owner against an infringer. This court found that no fraud had been proved, and that, therefore, the patent could not be ordered canceled. The Supreme Court, on appeal, took the same view of the case.

After the decision of Judge Carpenter in the Circuit Court, the few companies which had begun to manufacture and build exchanges took new courage and many others entered the field, and this new impetus assured our present great success in spite of all that has been done to discourage us.

After the decision of the Supreme Court in the Government case, the testimony was completed in the infringement cases which the American Bell Telephone Company had in the meantime (Aug. 5, 1895), brought against the National Telephone Manufacturing Company and the Century Telephone Company. The defenses in these cases included the same grounds of invalidity set up in the Government case except that of fraud, and the decision of Judge Brown, recently handed down, practically sustains all the defenses except one.

The Edison patent on the use of carbon in the transmitter was no doubt valid; but the question arose concerning it as to the effect on its life of Section 4887 of the Revised Statutes. The application for this patent was filed before Edison had taken out any foreign patents on the invention, but the patent itself was issued after he had taken out foreign patents, and, in fact, after such foreign patents had already expired. With one interpretation of the meaning of Section 4887, the foreign patent would limit the life of the United States patent, and the patent had already expired at the time of its issue. The interpretation of this section had already been raised in regard to other patents, but had never been passed upon by the Supreme Court, and it was uncertain what the decision there would be. There was pending before that court a suit known as the Bate Refrigerator Company vs. Ferdinand Sulsberger et al., in which this particular question was involved. This case was one of minor importance, but on the outcome of the same depended the question as to whether the Edison carbon patent, owned by the Bell Company and some important electric light patents owned by the General Electric Company, should extend for seventeen years or had already expired. When this comparatively unimportant Bate Refrigerator case came to a hearing before the Supreme Court, the side which was favorable to the Bell Company's contention was most ably and elaborately presented, Mr. Storrow, chief counsel for the American Bell Telephone Company, and other noted lawyers presenting very able briefs on the subject. The other side was also well represented, especially by Mr. Wetmore, of New York. There was, however, nothing to show that there was practically anything more at stake than the contest between the Bates Refrigerator Company and Sulzberger. At the hearing, however, a request was made and granted that Mr. Charles H. Aldrich, formerly solicitor general, be permitted to file a brief in the case on behalf of Milo G. Kellogg as "one whose interests as an inventor of telephone appliances, and as a stockholder in companies operating telephone exchanges and manufacturing electric light and other apparatus, would, in his opinion, be disastrously affected by an interpretation favorable to complainant of Section 4887, Revised Statutes." Mr. Aldrich's brief thus filed pointed out to the court the great interest involved in the suit, and the legal grounds for an interpretation of the section which would, in fact, limit and make the Edison patents ineffective. The Supreme Court decided the case in favor of defendant, holding that under Section 4887, United States Revised Statutes, the expiration of a foreign patent limited the grant under our laws to that time, and, as far as the statutes then stood, the Edison carbon patent became a dead issue.

However, while this Bate case was pending before the Supreme Court several bills to amend Section 4887 were introduced in Congress, the effect of which, if passed, would be to give life to the Edison patent for seventeen years from the date of its issue. The real animus and source of the instigation of these bills was not apparent. The fact of their existence and the real motive and effect of the same came to Mr. Aldrich's knowledge, and he prepared a memorial to Congress on the subject, entitled "The American Bell Telephone Monopoly and the Pending Legislation in Its Interest." A copy of this memorial was sent to every member of Congress. The effect of the same was that the real motive for the proposed legislation was exposed and thus the bills were defeated.

But to show how adroitly the affairs of the American Bell Telephone Company were managed we must now consider a few facts which were the result of the thought of great minds employed to prolong the monopoly. Edison having applied for foreign patents, and they recognizing the danger of limiting his rights under Section 4887, Revised Statutes, should their efforts fail to repeal or annul it, the Berliner application for a patent was, by shrewd manipulation, kept pending in the Patent Office for fourteen years, and he, so far as we have discovered, made no application in a foreign country under the statutes of which the patent in this country would be limited, but only in such countries the laws of which would not bring it under our court's interpretation of Section 4887, in view of the danger growing out of the Edison foreign patents. After the Berliner caveat and application had passed to the ownership of the American Bell Telephone Company, which did not claim a constant-contact telephone which would reproduce speech, but a make-and-break transmitter which would reproduce musical sounds, this able corps of experts in the pay of the company managed, after this delay of fourteen years, to obtain a patent by amendment, claiming just the invention that Mr. Berliner had disclaimed in his caveat and original application.

After the decision in the United States Supreme Court in the Government case, through the efforts of J. B. Leatherbee, treasurer of the National Telephone Manufacturing Company, Edward P. Payson, of Boston, a very able and conscientious lawyer, proceeded with the arduous task of completing the proofs to sustain the defenses set up in his answer to the bill of complaint in the case of the American Bell Telephone Company against the National Telephone Manufacturing Company.

Mr. Payson gave to this case a great portion of his time and his best thought from the time of his retainer in 1895 to the time the case was fully submitted to the court, November, 1899. Judge R. S. Taylor, having been selected by the Government as one of the counsel in its suit and being very familiar with the questions involved, was retained to file a brief and make an oral argument in the case against the National Telephone Manufacturing Company on behalf of the defense. Feb. 27 last Judge Brown, of the United States Circuit Court, District of Massachusetts, handed down his decision after considering the case from November, 1899, to that time, and from his rescript, indicating his deep study of the questions involved in this important case, the impartial words of the learned Judge clearly indicate his conviction as to the deep-laid scheme to prolong a monopoly.

We certainly should appreciate the efforts of these men who have so ably resisted the efforts of the representatives of the American Bell Telephone Company to retain that which had by law passed to the people, and no voice should be heard except in highest commendation of their work. Their intelligent and arduous labors have defeated the skill and cunning of those who were employed to try to

deceive our patent officials and our courts. I feel at this time it is not only the duty but the pleasure of this organization to make public acknowledgment of their services.

This combined effort has resulted in the decision of Judge Brown, in which he holds: First, that at the date of the application, June 4, 1877, Berliner had not made the invention covered by the patent issued to the American Bell Telephone Company on Nov. 17, 1891. Second, that the invention designated in the patent is radically different from the invention described in the application. Third, that the invention was previously patented by Berliner. Fourth, that Edison was the prior inventor. Judge Brown agrees with the well-known position of all telephone inventors that Berliner, so far as his claim to a microphone is concerned, invented nothing.

These facts, together with the policy of the Bell companies in dealing with the people, has been the chief incentive to invest in this field. The people were anxious for relief from their arbitrary methods, and have always welcomed an independent company.

Having proven our legal right to give telephone service by good and efficient methods, and having demonstrated our ability to compete with the old companies, it becomes now a question of working together for one common end, and it is important that at this meeting we consider such questions as will lead us to unity of action. The present year will add much to our present strength by placing a large amount of money at our disposal.

At the close of the address, on motion of Mr. H. D. Critchfield, general counsel of the Cuyahoga and U. S. Telephone companies of Cleveland, it was unanimously agreed to adopt the suggestion of the president and extend the thanks and grateful acknowledgment of the association to those who had so faithfully, honestly and enthusiastically guarded their interests in this great litigation.

The meeting then adjourned until 10 a. m. Wednesday.

WEDNESDAY MORNING SESSION.

The session on Wednesday morning opened at 10 a. m., when a paper was read by the Hon. S. P. Sheerin, of the New Long-Distance Telephone Company, of Indianapolis, on "Village Exchanges and Farmers' Lines."

SHEERIN ON VILLAGE AND FARMERS' TELEPHONY.

The telephone—which, after all, has only had its development in the last six or seven years—is a greater boon to farmers than to any other class of people. The great drawbacks of country life are its isolation, its meagre opportunities for social intercourse and its still fewer opportunities for protection. When we add to these the disadvantages of being out of touch with the market, and out of reach of the great news pulse of the country, the sum of the country life's shortcomings is complete. The telephone changes all this. No man can fully estimate its benefit to the farmer. It brings his ear close to the market tickers of the world; brings the weather report to his door, in time to protect his crop and cattle, and travels, what would be to him and his horses, weary miles, in the ordinary transaction of his every-day business.

It is, I am afraid, a slight reflection on the usual good sense of the average farmer, who has progressed, in other respects, out of the cheap way of doing things, to find him insisting upon putting up cheap, grounded telephone lines, on native poles, three or four hundred feet apart—marring the landscape, and furnishing temptations to profanity by those who have to use them. A poorly constructed and badly managed country telephone line is many hundred times worse than no telephone at all. There was a time when those things served their purpose as educators, but that time has passed.

The country telephone line (and all other telephone lines which go along the country road) should be considered as part and parcel of the road itself. They should not be considered as tenants of the road, or as something that is there by sufferance, or by the permission—grudgingly given—of those who, for the time, do not appreciate its advantages; but it should be regarded as a part of the road itself.

I look forward to the time when telephone lines will be regarded as such sacred property, that men and boys will no more think of interfering with a country telephone line than they do now of throwing stones at windows or killing song birds as they pass along.

In order, however, to be entitled to this high regard of the public the telephone must, by its outward appearance command the respect of the people. Telephone lines should be substantially and neatly constructed. They should be of the very best material—good, heavy, well-shaped poles (no pole shorter than 25 ft., nor smaller than 6 inches in diameter at the top); cross-arms should be of regular length, and the wire put on in a thoroughly mechanical manner. I have an impression that, as time goes on, and our high regard for the telephone increases, we may get along with shorter poles, and put out wires as near to the ground as electrical conditions will permit. My thought is, that we will not have to use very high poles anywhere, except at road crossings, and it is barely possible that we may reach a condition where it will be found easier to go under cross-roads than over them. Wherever it is possible I think that not more than one line of poles should occupy the same side of the road. It will be entirely possible to build a line, sufficiently strong and symmetrical, to take on all the lines that should go along any particular roadway.

Of course, it goes without the saying that all lines should be iron or copper metallic, and, as nearly as possible, the maintenance of the whole line should be under the control of one head—without reference to how many persons or companies may be interested in the pole line. One of the great troubles of the country telephone line—as, indeed, it is one of the drawbacks we all have in cities—is the trees. In the cities we are able to escape this annoyance very largely by the use of cable, but, of course, it would be impossible to do this in the country. Not taking into account the great additional cost of that sort of construction there are electrical considerations that make a continuously long cable line an impossibility. The trees on the country roads should give way to the telephone.

I am an advocate of trees, and believe that we should cultivate our forestry in every possible way, consistent with the discharge of our other obligations. But as it was necessary to trim away the original forests to make the roads, so I would trim away the trees along the side of the roads, which interfere with that part of the road which belongs to the telephone. Trees along highways, near residences, can just as well be set back 25 or 30 ft. They have no business on the highway or overlapping the highway, when they interfere with the uses of the highway.

The telephone is a proper use of the highway. In many respects it is the most important use. Being a comparatively new thing, it may take legislatures and courts a little while to appreciate all this, but just as surely as our American legislation and jurisprudence has found a way to clear all other obstacles from the path of material progress, so they will find a way to order the trees along the highways, set back out of the way of the telephone.

In my judgment, village exchanges should be encouraged everywhere, and these village exchanges should have direct communication with the county seat exchanges and the exchanges in other towns of the county; and these exchanges, in turn, should be connected with the long-distance exchanges of the several States.

With all due respect to the manufacturers—and I think the manufacturers are entitled to a great deal of credit for the development of the telephone business—I cannot help the feeling that they are very largely responsible for a great lot of shoddy, inefficient and wholly abominable telephone equipment in the country. They go upon the theory that the farmer wants something cheap, and that the way to catch him is to present a very low-priced article, without very much reference to how long it will last or what service it may give him in the meantime. This is little short of criminal, and cannot be too strongly condemned.

This association, and all other people largely interested in the telephone business, who want to escape responsibility for bad service by other people, as well as by themselves, should set their faces firmly against the manufacturers who make specially "Cheap John" equipment for farmers' lines.

The battlefield of the great telephone war, which has been raging in this country for the past five years—with the victories always on the same side—has been largely transferred from the cities to the country. The Bell companies, in the days of their monopoly—and, in fact, until quite recently—positively refused to furnish service to the farmer upon any terms. Now they have changed their minds about that, and seem to have concluded that the farmer and the villager are not such bad fellows after all. But their repentance has come too late.

When the first independent telephone exchange was constructed in Indiana, my State, the Central Union Telephone Company had been paying, for 12 years, on a capital of $6,300,000 (three-fifths of which was pure water) annual dividends, ranging from 4 to 6 per cent. They had no bonded indebtedness and no floating indebtedness, that was reported. When the fight with the independents began they ceased paying dividends—the last one being paid in 1895. In 1897 they

borrowed $2,500,000; in 1899 they borrowed $6,000,000—two and a half of which was set aside to pay the holders of the first mortgage of two and a half millions. They now have, in addition to this $6,000,000 mortgage (according to recent publications), a floating indebtedness of $1,250,000. Now, let me tell you what all this has resulted in. The Central Union now has (as shown by their own figures) 22,000 telephones in the State. The real number is smaller than this, but we can afford to be generous, and I propose to give them all they claim. The independent telephone interests have, in the State of Indiana, by actual count, 52,469 telephones. I know you will excuse me if I repeat those figures. *After a "war expenditure" of $7,250,000, begun upon the independent movement when there were less than 3000 independent telephones in the State, the Central Union now has, for its expenditure, 22,000 telephones, and the independent movement has* 52,469. The total population of Indiana (according to the census of 1900), is 2,516,000. There are 92 counties in the State, and there are 27 of these, in which the Central Union (or any other Bell company) has no exchange, large or small. The population of these 27 counties aggregates 491,000, and the aggregate number of independent telephones in these 27 counties is 14,262. The total number of Central Union and other Bell company telephones, used at toll stations only, in these 27 counties, is 197. Of the millions invested in independent telephony in Indiana, less than $100,000 had come from outside the State.

The independent movement gives opportunity for self-helpfulness and intelligent co-operation. That which a man can do for himself is most likely to be quickest done. The flexibility of the independent plan is its greatest recommendation. There is no honest local movement that cannot find a warm welcome and a happy home in it. It will not do to say that good service cannot be given by the independents. Every unprejudiced man will say that the most indifferent independent service in the country to-day is very much better than the average Bell service was when the independent movement began.

Mr. J. B. Ware, of the People's Telephone Company, Detroit, Mich., in the discussion on Mr. Sheerin's paper, pointed out, among other things, the distinction that existed in farmers' telephoning that had not been recognized. Some farmers used their telephones for business purposes, and they were desirous of having individual lines, as any one must who was in commerce and surrounded by competitors. But a great bulk of farming telephony rested on mere sociability, and he had been very much surprised to hear an experienced man say that usually the farmers would rather have six on a line than not. In fact, if some one in a farming district had six on a line he could go into the same territory and beat him out simply by putting, if possible, 20 on a line. Merely for the sociability of the thing, the farmer wanted to have as many on a line as possible. Farmers had built their own lines, connecting up their own systems with cheap instruments and switches, some one farmer allowing the central to be established in his house, and the farmers were getting their service for nothing. It was difficult to build up a toll line business with that set of conditions to be faced; they were really a menace to telephone development at the hands of some of the independent companies. In Michigan $12 was the limit for farmers' service, and some rates were even lower. But, in the long run, in two or five years, the farming communities would outgrow these cruder conditions and themselves demand more separate lines, or lines with at best only two or three on each. That meant that the present pole lines with 6-pin cross-arms would be inadequate, as they would soon be compelled to furnish a large number of additional circuits. They ought even now to be putting in poles to carry 10-pin cross-arms, as the proper equipment for the near future. This change was the salvation of the telephone industry in Michigan and elsewhere, and the consequent higher rates would not be fought, because the farmer was a reasonable man, willing to allow a fair return on any investment. He was glad to note the frank admission by Mr. Sheerin, that the farmers had proved of immense value to the independent movement. The Bell people, or some of them, had reached the point of understanding this, but he had heard that the $100,000 president of the Bell Central Union Company was dead opposed to farmers' lines, and had even caused them to be taken down. There was in his opinion no way for the Bell licensee companies to drive out the independents except by getting the farmers away from them, and he did not believe this could be done. In large portions of Michigan the success of the independents was due to the fact that the farmers had been connected into the local exchanges. The ideal farmers' exchange was that which in turn was part of the system of the village or city exchange, building up from party lines to the trunk lines to the city exchange. In conclusion, Mr. Ware claimed very emphatically that the independents were now giving much better service than the standard achieved by their old rivals. Even the apparatus was now generally superior, as well as the quality of construction.

A member, with reference to the mention of the Central Union System, then read an item from the Chicago *Record-Herald*, of June 11, in which Mr. Sabin's circular to Central Union stockholders was quoted, telling them that several millions must be raised at once to put the plant in good condition for competition.

Mr. Fisher called attention to a decision by Judge Phillips in Ohio, ruling that telegraph and telephone companies, lighting and street railway companies, etc., having proper franchises, or the city or community itself could remove trees, or parts of them which were an interference with the reasonable use of the highway for purposes of traffic and commerce. The case was that of Keith against the Little Consolidated Street Railway, of Cleveland, where the company had to get eight trees out of the way, whose limbs were in the way of the wires. Judge Phillips threw the Keith case out of court.

Mr. T. J. Fricker, of the Ashtabula Telephone Company, made a long and very humorous address on the general relations of independent companies to the farmers, and in opening quoted an analogous case with a similar decision from the courts of Michigan, holding that public service companies had the right to cut every branch and every tree that interfered with carrying out the objects for which their franchises had been granted. He was himself engaged also in rural electric railway work, and quoted a case in his own experience where, because of the high voltage of the trolley lines, the position of some of the telephone circuits had to be changed. One man had interfered, and had spirited away their poles, but under threat of arrest by the constable he had restored the missing poles to the very spot from which they had been taken outside his property. He then paid a handsome eulogy to Judge Thomas for his work, and held that but for the sustaining power of the association and its protection many an independent company would long since have been wiped out of existence. As to the general success of the movement it was evident. In Ashtabula they began, for example, with 125 subscribers, and now had 900, and could not take care of the rapid growth. The great, vital thing now needed was the extension of the long-distance lines.

As to farmers' lines a few years ago, even to the independents, the phrase had no meaning. Now that branch was highly important, and must be adequately dealt with by the superintendents, who should see to it that the Bell companies did not supply a service of that kind, and thus compel many a country business man who could not afford it, to put in two telephones. Another point was the telephone girl, in whose behalf he addressed some earnest remarks to his fellow members. It was no use putting in a fine plant and then fall down in operation. If the girls were properly cared for and treated the service would be good.

DEVELOPMENT EAST OF THE ALLEGHENIES.

Mr. Charles E. Wilson, of the Keystone Telephone Company, of Philadelphia, who had been asked for a paper on "Independent Telephone Development East of the Alleghenies," apologized for inability to prepare it, owing to work on his new exchange, which will be in operation by October. He invited the convention to Philadelphia next year, and volunteered some very generous hospitality. As to the exchange, their conduit and cable system had been laid out for a capacity of 30,000, all underground connections, and there would be two main buildings, ready in 90 days. Some 4000 contracts for five years had been signed up, and they were still coming in at the rate of 75 or 80 a day. They had been advertising in the local papers some $2,000 a month, but, although that had been stopped, the names were coming in just as freely. The switchboards would be Kellogg. The telephones would be manufactured under contract, according to the specifications of their own engineers. Their rates would be $80 for single business lines and $52 for two-party lines; residence $48 for single lines and $36 for two-party lines, nothing higher than two being used. The old Bell business rate had been $160 unlimited service; all other service on the measured basis, and in the suburbs four and six on a line. In January the Bell people had 10,025 subscribers in a population of 1,320,000. In reply to an inquiry, Mr. Wilson stated that they had got along very well with the Pennsylvania Railroad, although that still had a long Bell contract. They had had a little trouble with the Reading system, but they had found the way of quietly bringing them to time.

Senator C. W. Kline, of Hazelton, Pa., president of the Interstate Telephone & Telegraph Company, of Pennsylvania, then read a brief paper on the subject assigned to Mr. Wilson. Mr. Kline said that under the splendid management of Mr. S. E. Wayland, superb plants had been installed in Scranton and Wilkesbarre, covering the Lackawanna and Wyoming Valleys, with an easy possibility of 30,000 telephones in sight, and 7000 now at work. Allentown, the center of the Lehigh Telephone Company's system, has a splendid system, with a possibility of 5000 telephones, with about 1800 installed. Reading is being built. Easton is working up the lower Lehigh. The Overland of Lehighton reaches out its tentacles for everything in sight. The Anthracite, of Hazleton, embraces everything in lower Luzerne, Upper Carbon and Northern Schuylkill counties. The Standard, of Bucks and Montgomery, is now being rebuilt by Mr. G. S. W. Brubaker, covering all that section. The United Telephone companies embrace Norristown, West Chester, Lancaster, Lebanon, all of the Schuylkill, Northumberland, Montour and Columbia counties, and the north and west branches of the Susquehanna. Harrisburg is building, and Columbia. York connected with Carlisle via Chambersboro is extending its lines in every direction in York and Lancaster counties, and is connected west to the Alleghanies. As to New York State, he remarked that fine plants had been installed at Rochester and Albany. The United Telephone Company, of Pennsylvania, covered the southern portion of New York State. The Maryland Telephone & Telegraph Company had a splendid plant at Baltimore, and the chain of independent companies stretched south along the Atlantic to the Gulf of Mexico. He predicted that in a very short time the independents would have in the territory east of the Alleghanies more telephones than the Bell would have in the same State both east and west of that range.

As to toll lines, Mr. Kline said that they were "short" on those, and "long" on local exchanges. But already the Interstate Telephone & Telegraph Company had built lines in the eastern portion of Pennsylvania connecting up that entire region with some 14,000 telephones, and it had its terminal at Trenton, N. J., thence reaching over the lines of the State Telephone Company, of New Jersey, up to Jersey City, which meant New York. The Interstate Company was also ready and willing to reach out across the Alleghanies and make the chain of service complete between east and west. There were at present too many companies in the field ambitious to control the situation as to toll lines, but in due time they would have to poll their interests and bury their differences. From the independent standpoint, the situation east of the Alleghanies was all right, and with 50,000 instruments they meant to take the "right of line" in the movement, and stay there.

Mr. C. E. Stinson, of the Rochester Telephone Company, N. Y., then continued the same topic and gave with considerable interesting detail an account of the systems in Rochester, which was described and illustrated in the ELECTRICAL WORLD AND ENGINEER, in the issue of Feb. 23, 1901. They had at present some 3600 telephones in service in a population of 160,000. The Bell people claimed 2200. On their anniversary of opening in May no fewer than 15,000 people had visited his exchange, showing the popular interest. He had about 100 miles of pole line, and had everything covered within a radius of eight miles of Rochester. With them, farmers' lines were different from what they had been hearing about, and brought $40 to $50, five-year contracts, payable quarterly in advance. Their pay also to the girls was high, averaging $5.44 per week. Mr. Stinson replied to a number of inquiries, and closed by inviting the association to visit Rochester.

The morning being far advanced, the remaining business on the programme was carried over, and the meeting adjourned to meet at 10 a. m. Thursday. A group photograph was then taken outside the Convention Hall, and the association as a body spent the afternoon on a trip down to Niagara Falls.

THURSDAY'S SESSION.

The Thursday morning session opened with the reading of a paper by Mr. L. W. Stanton, switchboard manager of the Cuyahoga Telephone Company, Cleveland, on "Exchange Service," accompanied by a number of load diagrams.

STANTON ON EXCHANGE SERVICE.

This subject may be divided into three important branches: Reliability, promptness, good transmission. Any of these, if not up to its highest state of perfection, mars the general result.

For good transmission as well as apparatus we must depend upon the manufacturer. The independent telephone interests are to-day in greater danger on account of some of the inferior apparatus that is being thrown upon the market than they have ever been from the old monopoly. Some of the apparatus that is being sold to-day by the independent manufacturers is a curse to independent telephony. It only half works. It is unreliable, it does not give good local service, not to mention the poor results obtained when used for long-distance lines. Every telephone that is installed to-day should be one over which conversations between New York and Chicago can be carried without difficulty, for it is only a matter of a short time till every telephone in this broad land will be connected by a network of long-distance lines to every city, village, town and hamlet. The continued use of inferior apparatus will mean unreliable service, poor transmission, expensive maintenance and a final discarding of the original installation at a great loss, and, worst of all, dissatisfied subscribers. I feel sorry for the independent interests when I see this inferior apparatus being installed in exchanges that are being newly equipped for it means a loss of prestige. It is true, it is difficult for the independent telephone companies to select the best apparatus, for, as a rule, their experience has been limited to the use of apparatus that was furnished them a few years ago. Another reason is the unparalleled strides that have been made in telephone manufacturing within the last few years. They have been accustomed to the old magneto drop board, which is undoubtedly a thing of the past in exchanges of any size. It is the opinion of the writer that in any exchange of over 100 subscribers, where suitable arrangements can be made for current, the only thing to install is a central energy lamp signal board with double supervision. This style of board saves an operator a great many moves, such as restoring line signals, and cutting in on subscriber's line to inquire if party answered, or if they are through talking, for with double supervision she can tell at a glance whether the called-for party has answered, or if the conversation is finished.

Wherever an exchange requires three or more operators a multiple board should be installed, for when transfers are used they impede the service and add permanently to the operating expense. On a large transfer board, you almost double your work, for nearly every call has to be trunked to a second operator, while with a multiple board each operator handles her subscribers' calls direct, without asistance. Another distinct advantage of the multiple board is: One operator in the evening and on Sundays can sit at one position and answer all calls through the multiple. In this way, with double supervision, she has control of the entire board.

I do not doubt that some of you are of a different opinion, but I will endeavor to show why this class of apparatus is superior. It gives better service. It is cheaper to operate. First, because it requires fewer operators. Second, because it dispenses with hundreds of local batteries scattered over miles of territory. Third, it does away with an expensive piece of mechanism, the generator, with its cog-gears, shunts, commutators, etc., which are a constant source of wear and tear. Fourth, in eliminating the generator and batteries, the number of inspectors can be reduced, which is no small item.

The following figures will give some idea of the saving in the cost of current for an exchange of 1000 subscribers. Taking the cheapest form of battery, which is the dry cell, at 15 cents each, and using two cells per telephone, which is modern practice, it gives a cost of 30 cents per telephone. Allowing the battery a life of one year, which is more than the average, we have a cost of $300 per year, or $25 per month for the 1000 telephones.

In one of our central energy exchanges of something over 1000 subscribers I find the average cost of all current for operating line signals, supervisory signals, and all current used for talking, amounts approximately to $6.50 per month, which is about one-fourth of the cost for current for operating the same size system with local batteries, to say nothing of the additional cost of labor for renewal and maintenance.

From a number of monthly reports of trouble covering both common battery and magneto type exchanges, I find that the number of cases of trouble at the subscriber's instrument is from two to four times as great for local battery plants as it is for common battery plants. With one of the latest types of central energy telephones the trouble at the subscriber's station is reduced to a minimum. There is practically nothing left but the transmitter, receiver and signal bells, and these, as they are made to-day by some of our best manufacturers, almost eliminate the possibility of trouble. This coupled with accurate and scientifically constructed apparatus at the

central office gives the ideal system, and it is only with an ideal system we can give ideal service. It is often remarked that it requires better line construction for common battery plants, which is true to a certain extent, but any good line will work well with common battery, and in some cases this system is worked on a common return.

Telephone men are beginning to realize the importance of good line construction, especially when they see the great difference in the expense of maintenance between well and poorly constructed lines. The Bell Telephone Company's plant in St. Louis, in whose employ the writer spent several months in different departments, during the building of their new common battery exchange, offers a good example of first-class construction. In building this exchange they were extremely particular that every detail be carried out in the best possible manner. It seemed at the time that it was a waste of money, but I have since realized that it was money well invested. The entire system was put in so that it would stand the test of time. The interior wiring was protected in every possible way. Telephones were placed on the wall in the most substantial manner. Cable work and line construction was unequaled. As a result, the number of cases of trouble per telephone is less than that of any other telephone exchange in the country. The parent company has awarded them the credit of giving better service than that given by any other licensee company, and in the face of the strongest competition, I understand their financial showing is very good, which would not be possible with slighted details and poor construction.

The telephone business stands to-day on a higher plane than ever before. The independent movement has forced the Bell Company to put forth their best efforts, and this in turn has stimulated the independent companies, but telephony is yet far from its ideal goal. Look through the operating rooms of some of the large Bell and independent companies and notice the number of idle operators, while on the same boards there are operators that have more calls than they can properly handle. Few telephone men seem to have realized the importance of equalizing the load among the operators, that is, placing enough lines in front of each operator to properly load each position. I submit some charts, giving the peg count curves which convey the meaning more readily and show where thousands of dollars can be saved in the cost of operating, by reducing the force, besides giving more efficient service.

The operating force of a large exchange is one of its most important factors. If the operators are well disciplined and courteous, the subscribers are quick to notice and show their appreciation. Even a second or two is noticeable to a subscriber when awaiting an answer from central, and on hearing the operator call "number" in a brisk, clear tone, with a rising inflection, it conveys the idea of discipline. But if the operator answers with a falling inflection and uncertain voice, it gives the opposite impression; in fact, the operating force is nearer to the telephone public and wields a greater influence among the telephone's users than any other class of individuals connected with the company. It is through the operators that we dispense the little courtesies that make our service popular. A few weeks ago I was examining an independent telephone exchange which was exceptional, inasmuch as it had over 100 subscribers, but through the carelessness and neglect of the manager, who lived in another town, in maintaining the telephones and outside construction the subscription list had been reduced to 25, and those 25 I am told remained on account of the courteous treatment they received from the operator, who was certainly exceedingly kind and obliging to the subscribers. On the same day I visited this exchange I was in another small city, and while talking over the telephone situation with one of the citizens there he assured me that the chief operator of the Bell company at that place had done more than any other 20 causes combined to make the Bell company unpopular. These two cases just cited certainly show the importance of courteous operators. I remember an instance where I reprimanded an operator who had formerly been with the Bell company for speaking crossly to a subscriber. Her answer was, "Why, Mr. Stanton, you ought to hear how cross the Bell operators are, and you would not think we were cross."

I prefer not to employ Bell operators. As a general thing, they have some undesirable traits which become more prominent when they try to show their importance to the "new company"—as they term it. There is always an army of applicants besieging a telephone company for employment, and if you are any judge of human nature you will not be long in choosing a list of girls, who, with proper training and appreciation of their efforts, will make a very efficient corps of operators. There are few managers who realize the great advantage derived from the proper training of their operators. As a general thing, an operator after being employed is given a seat at the switchboard beside one of the old operators, and is told to watch the other operators and learn what she can, and in a short time she commences to answer a few calls, and from that time on she is supposed to be an operator. As a matter of fact, she is far from being one. She should become thoroughly familiar with all the rules, and should have their meaning explained to her. She should be taught how to handle the plugs with the left hand as well as the right. Until she can use her left hand as easily and naturally as her right she is only half an operator. She should be taught how to answer two and three calls at the same time without interference. It is only in this way that an operator can answer quickly and handle the number of calls that she should. Walk through almost any operating room, especially that of an independent exchange, and notice the number of wooden arms and mallets that are in use. Notice the number of false moves and untrained voices, and you will realize that the company is spending unnecessary money. By wooden arms I mean that the operators do not use the left arm any more than if it was wooden. By mallets, I mean that they are driving the plugs in by the heel of the hand, breaking the tinsel of the cords, causing a cut-out, which means unsatisfactory service, besides the expense of replacing the broken cords. By false motions, I mean that the plug is picked up with one hand and passed to the other instead of being inserted with the hand with which it was picked up. These are only a few points in which operators should be trained.

The operating room should be conducted on a merit basis, and promotions be made according to the efficiency and courtesy of the operators. During each month competitive tests should be made to determine the speed and courtesy of operators in answering subscribers, and those having the highest general average as regards speed in responding to calls, courteous treatment of subscribers, obedience to rules, promptness in reporting for duty and regularity of attendance, etc., should receive some sort of promotion. Those who through these tests prove to be unqualified for the position of operator should be discharged. A form of promotion which I have found to work well is to give the operator having the highest general average the most desirable hours, and those least efficient the night hours. Another reward of merit which works well is to recognize an operator's ability by giving her a small raise in wages. I do not believe in giving an operator a large raise in wages at one time, but to encourage them and to show that their efforts are appreciated by giving them an increase of, say, $1 at a time. This may seem like a small amount, but a girl will appreciate this raise as much as a man would an increase of $5 or $10, and by giving a small raise at each time you can reward their efforts more frequenly and thus get better results. Another method which I find works admirably is to arrange each operator's merit standing, showing who is first, second, third, and so on, leaving a copy in their recreation room. This starts a friendly rivalry among the operators, which produces results that cannot fail to make our service popular.

Every large operating room should be presided over by an A1 telephone man, who is thoroughly acquainted with every detail of the business, and who realizes the necessity of prompt action in the trouble department and the proper disciplining of the operating force. Last, but not least, he should have the faculty of dealing with the telephone public.

Mr. Stanton then explained a large number of peg count curves which accompanied his paper, compiled from independent exchanges. He said that a girl could easily take care of 2000 calls a day. In Chicago, the Bell exchange count from tests over a series of five years, showed a possible 528 calls per hour. The figures from leading Bell exchanges showed that one-eighth of the number of calls in the 24 hours gives the peak of the load. The result would be something like 4000 calls per 24 hours. Of course, with the old magneto board it took six times as long as with modern multiple boards, especially when modern plants included intermediate boards. He knew of only one independent intermediate board, namely, that of Mr. Curtis at Sandusky.

Mr. Curtis remarked that his operators were averaging 300 calls per hour, and he was giving a 2½-second service, and not 4 or 5.

Mr. Stanton said it was absurd to put only 100 subscribers in front of each operator.

Mr. Judson, of Minneapolis, said that ordinary peg count would not apply to his case where he had four or five operators for four

hours loaded to death, although at other hours they had an easy time. They were stock and produce exchange operators. In Minneapolis they also had an information bureau, giving news of baseball and football games, etc. About 4 or 5 in the afternoon, in their sporty community, the inquiries poured in. Ordinarily when the rush was over daily he "lifted" some of the operators after the close of the stock exchange. The average during the 10 hours of business was 1400 calls.

Mr. Stanton instanced, as to distributing business, the case of Marshall Field in Chicago. There were 20 trunks leading from the private exchange to central, and those trunks were busy every minute. Now, one operator could not handle them all, so they were distributed throughout the exchange. He then described the method used in the Bell exchange in St. Louis, where at 6 p. m. the operators drew back from their positions and half the force went off. In short, the exchange closed up part of its system just as a business man closed up his store. The board was in the shape of a curve, and it could be noted that the business was bunched at the ends, where the operators seemed to be as busy as usual. To put the case in a nutshell, profitable exchange operation depends upon equalizing the load and giving every operator a full and equal amount of work.

Mr. Dougherty asked that in some way steps be taken to impress on members the value of such work as shown by Mr. Stanton.

Mr. Judson suggested that instructions be given as to methods of taking peg counts and compiling the curves.

Mr. Fisher admitted the value of peg counts, but asserted that it did not always mean good service. He had been the victim of a large Bell exchange taking peg counts, and it had been not merely 4 seconds per call, but 10 minutes.

A paper was then read by Hon. E. B. Fisher, Citizens' Telephone Company, of Grand Rapids, Mich., on the subject of "Bell Methods."

FISHER ON BELL METHODS.

I do not expect or hope to say anything startling or novel. Most of you already know all that I shall mention this morning—have had experiences and observations similar to those mentioned; but to recall them may induce the presentation of other and really new experiences, and may prove an encouragement or a suggestion to those just entering or about to enter the independent telephone field. The man or corporation that should ignore competitors, that fails to study their mutual conditions, and profit from them, could not expect to succeed in competitive enterprises and efforts. The man or corporation that maliciously or falsely discusses a competitor and its business in the hope that thereby its own business may be benefited makes a grievous mistake, and in the end loses more than is expected to be gained. With these two thoughts as premises, I enter upon a discussion of Bell methods. I could not, under any circumstances, consider such topic in the spirit of criticism only, and were I expected to do so should certainly decline the assignment. The gentlemen who have been conducting the business in the various constituents of what we know as the Bell Company are our neighbors and friends. Many of them have been in the telephone business for years, some for quite 20 years. They have extended experience, they are competent, successful business men, and we can learn much by observing their methods, and undoubtedly can find many examples in their conduct of business from which to profit.

One of the most serious criticisms I have had occasion to suggest as to independent telephone companies is their lack of system, their lack of carefully analyzing conditions and experiences and their making systematic deductions therefrom. They have engaged in the telephone business, in too many cases, much as the original Bell corporation did, and have been learning from sad personal experiences, rather than from profitable observation of what had already been "threshed out" in the evolution of the Bell system. It is highly essential, now that the independent systems are becoming larger, more complex, and intimately related with each other, that thorough system shall obtain; that first-class construction shall be the rule rather than the exception; that uniformity of practice in the manner of toll service, in the division of revenue arising therefrom shall obtain; that those conducting the business shall exchange experiences, thus enabling all to learn of mistakes and avoid them, and to secure the advantages of improvements that may be devised. The exchanges of the Bell company throughout the country have for years enjoyed the interchange of opinion and experience, and through the manifest advantages of such interchange, have avoided many difficulties and secured many betterments. We can and should copy this feature. We should meet each other frequently, individually and collectively, should keep in touch with each other by correspondence as well as over the wires—when we hear of a good thing, let our neighbors know of it; when we discover perils or uncomfortable conditions, warn our friends. The Bell, in a sense, although composed of many subordinate companies, have been one family. We can retain our individuality, maintain our ambitions to be the first in our chosen sphere of action, and still remember that we are a part of a family. Some have been inclined to suggest that our friends of the Bell company had too much system. As the business develops it begins to appear that too much system is less expensive and less foolish than too little. If the managers and operators of independent plants shall more carefully and fully analyze the cost of conducting their business in the different departments and the results therefrom, many errors will be avoided and the ledger balance on the right side will unquestionably grow. In systemizing business, we have much to learn from Bell methods. We should gain this knowledge and improve on it.

It is undoubtedly true that the conduct of a monopoly often results in somewhat of arrogance on the part of those who are at the head of such monopoly, or who hold responsible positions in the management of its business. Such people naturally come to feel that they can do about as they please, and if patrons or the public are not delighted therewith, what odds. I have heard gentlemen, who are listeners to this paper, more than once offer the suggestion that they would not care for the service of certain Bell employees who had applied for positions, because they were too "cranky." We can see for ourselves how natural it was that crankiness grew upon many officials and managers of Bell plants. They were not obliged to consult the wishes or desires of the public to secure their business and profits. One could take telephone service on their terms or let it alone. That was all there was of it.

This spirit of crankiness, so natural under the circumstances which engendered it, is the exponent of general conditions which produced other peculiar manifestations often noted the past few years. We should carefully consider these manifestations which are intended or expected to affect our own business, and, by interchange of observations or experiences, help each other and counsel or warn those who are about to engage in the independent telephone business. I well remember when, a little more than six years ago, we began canvassing in Grand Rapids, Mich., to secure the moneys with which to build the plant of the Citizens Company and for patrons of the same, the many stories which were afloat among our people as to our business. It was confidently asserted by representatives of the Bell company in our city and State that we never would build a telephone plant, indeed, that we had no intention of so doing, and were only trying to make money by being bought out. We were, in effect, it was intimated, intending blackmail. It was said that we could not build, could not get material, could not properly combine the material when we got it, could not find apparatus that was not infringing, could not get a switchboard that would work; would not know enough to set poles, string wire thereon and make them stand up. Even after we had actually begun to install telephones, those who had given us contracts were prompted to bet that we never would give service. There were infringement suits which may have been really expected to put a quietus on our enterprise, but these did not any of them succeed—it scarcely seems possible that some of them could have been expected to.

We have been giving service for more than five years, and the company which was then organized with but $100,000, authorized capital, has grown until it has to-day in service more than one-half as many telephones as the Bell had in the entire State of Michigan but five years ago, and has an authorized capital well toward one-half what the Michigan Telephone Company then had. And yet to-day similar predictions and commentaries upon like enterprises, even in Michigan, as well as other States, are indulged in by our neighbors. Officials of the Erie Company have informed the public through the press within a few weeks that the new independent plant will never be built in Detroit; that the People's Company in that city never will give service. When, in your respective localities, the Bell resorts to such methods to dissuade the public from patronizing them, to persuade them that you are not intending genuine business, you can comfort yourself with the fact that you are not singular in this experience, and you can point to results in other localities and say to your friends, "It is an old story, and no truer here than it has been elsewhere."

If you get started with service and you find that your patrons receive circular letters suggesting that the Bell is owner of letters patent

"steen hundred thousand and steen," and that all who use the independent apparatus infringe such letter patents and are liable to prosecution for using the same, do not flatter yourself that in this method the Bell company is distinguishing you beyond other independent companies. Such things have been done repeatedly. You have yet to hear of a subscriber who has been so prosecuted, and you can very safely guarantee your patrons against any damage that may be awarded by any court under such suits, and that you will pay all costs for defense. If you should find that the Bell company, which has frequently informed the people in your community that its former rates were the lowest they could afford to make for its service in your locality, has, upon the development of your competition, resorted to free service, or much less than cost rates in an effort to destroy you, do not be fearful that such practice can really damage your company; do not imagine that you are enduring an experience novel in the telephone business. No, not for a minute, when the Bell resorts to this method attempt to meet competition by establishing like rates, or lower rates, for your own service. Begin the education of your people, take them into your confidence, tell them the truth about your business and its results; insist upon a fair profit, upon reasonable returns on the actual investment, after giving good service, and you will find the people ready to pay your price rather than to get absolutely free service from the competitor. Do not resort to other tactics because there can be but one result from such procedure. This Bell method is a "war measure," pure and simple, and if it could succeed would be followed by such advance in rates as would fully compensate that company for the temporary concession of free service or less-than-cost rates. This fact has but to be stated to intelligent business men to be apparent to them, and to influence their action. This method, which has been practiced by the Bell subordinate companies in considerable regions of the country, so far as I know, never yet has succeeded in taking away the patronage of an independent company honestly striving to give good service at a reasonable rate. The company which shall reduce its rates below a reasonable point in a struggle with the Bell company is doomed the moment it shall do so.

What do you think of party-line service? One of the methods of the Bell company, in its efforts to meet the lower rates of independent telephone companies, has been to introduce, quite largely, party-line service with important reductions in rates for such service. Has it been successful where you have observed it? Is it a serious menace as a competitor? Of course, we know that the new president of the Central Union and the Chicago Telephone companies, who still retains his position at the head of the Pacific Coast Company—all Bell—is a staunch advocate of this sort of service. He is a gentleman of extended experience and wide observation in telephony, and for that reason his opinion is not to be lightly dismissed or treated with indifference. We are this morning discussing Bell methods in the hope that we may learn from them and profit from either accepting or avoiding their example. My own observation has been that party-line service is largely "a snare and a delusion," where given in city exchanges, and is not a competition that we need fear. It is evident that no devices have yet been invented which will permit more than two parties to use the same line at the same time, so when any pair on a party line holds the line, others must wait. Should this sort of service be generally used, the difficulty of securing your own line and of getting connections with other parties on similar lines is manifestly very greatly increased. We all know how impatient the average telephone user is to get service the moment it is wished—you have known subscribers ready to swear that the girl kept them waiting two minutes for a connection when it was not to exceed 20 seconds. I do not believe that you will be compelled to resort to party line service to meet this method of the Bell competition. The B. W. C. service, which was expected to work wonders three or four years ago, is not very generally popular.

No discussion of recent Bell methods would be useful if we did not consider minute rates for toll service. What is your observation on this topic? The high authority from the Pacific Coast who is trying to stifle competitors in the Central Union territory and to prevent it in Chicago, who is indeed regarded as a possible head of the American Telephone & Telegraph Company, is the father of the minute-rate service. He sets great store by his scheme, and has secured its adoption in considerable territory outside of that which he controls. We, in the Michigan territory, find it one of our competitions, and have not quite made up our minds as to its present and probable effects. However, on general terms, it is fair to state that it is causing considerable friction and dissatisfaction. The average telephone user is ready to affirm that he has not used the service so long as he has been charged for. He considers himself a victim of overcharge, and believes that the minute-rate is intended to thus increase the fees of the telephone company which he was inclined to believe were already quite large enough. If the average business man, on a long-distance connection, can actually accomplish his conversation in a single minute, it strikes me that at the price for one minute's connection, the line cannot earn enough, for we all know that quite as much time heretofore has been spent in getting two parties to talking as is occupied with their conversation. Now, if the time for securing connections cannot be reduced and the time of using is reduced, with theoretical reduction of pay, service would be less profitable to the companies than on the three or the five-minute basis. If the average subscriber is expected to use the line on a three or five-minute basis, why not make rates upon that theory? That would be fair to both companies and patron, and secure the desired revenue, even if but one minute should actually be used. The purpose of this paper, as before intimated, is to set you to talking about your mutual experiences and to induce discussion rather than to state conclusions.

In Michigan our neighbors have taken a new departure within the last few weeks. Formerly, they refused to admit that any other apparatus than the Bell could be successfully used in telephone service. The sub-companies of the parent company were supposed to have a hard and fast contract forbidding the use of any other apparatus, and forbidding connections with any other apparatus. Latterly the Michigan telephone companies have been attempting to secure, in a few instances, toll line alliances with companies formerly built and still continued, as far as exchanges are concerned, as independent companies. The Michigan company has said, in effect, to such companies: Keep your local exchanges, even your own toll lines; take control of the exchange business in your locality, but enter into a contract for toll connection outside your territory through the Bell system. It will give you equal percentages on originating business to those you have heretofore enjoyed, and provide you with more extended and superior toll line facilities. This late Bell method is insidious, and it is not strange that in some cases it is successful. Where such a contract is made exclusive—and, of course, they try to make it exclusive if possible—it subtracts by so much from the efficiency of adjoining or neighboring independent service. So anxious has the Michigan Telephone Company become in this matter, I believe it is true that it has been willing to make arrangements in some cases for a divided toll service where it was impossible to secure an exclusive contract. This Bell method is one of the most threatening efforts yet made, and yet has its silver lining. The strong independent companies, with considerable toll line facilities which have been growing, have not been influenced by such propositions. Only the smaller and weaker companies have made such contracts with the Bell company. Of course, no other independent company has been willing to parallel the lines of a neighboring independent company, no matter how inferior might be such neighboring plant, or how imperfect its service. Now that sort of territory will be provided with up-to-date independent plants. This recent manifestation would seem to indicate that the parent company must have consented to an abandonment of the exclusive feature of its contract with subordinate companies.

I believe that the Bell habit of ignoring the farmers—the small villages and the country—has been an error. I think that in this department of telephone service, a proper development of party lines may be made with great advantage to the communities served and at fair profits to the investor. There are regions in Michigan—and probably each of you could repeat the same tale—where the Bell is beginning to compete with independents in their own field in this regard. I say their own field, because the independents were the first to deliberately provide this sort of service. This Bell method of following a good example may prove a formidable competition, and may materially strengthen their smaller exchanges and their situation if they shall first enter new territory with this sort of service.

There was a time when I think it was actually believed by the average general manager or prominent official connected with the Bell telephone companies that an independent company could not possibly secure intelligent, experienced employees. They thought that we would be compelled to go through the process of evolution which was so tedious and so costly in the earlier days of the Bell company; that their employees would remain with them. They even thought in some localities that an independent company would not get exchange operators, and in some instances employed superfluous help simply to keep them from entering the service of independent

competitors. Some know more to-day on this topic than they did a few years ago. A large number of the brightest men in telephony have found employment in the independent field, and there is scarcely one in this Convention Hall who has not had frequent opportunity to secure many more of the most important employees of the Bell company than he has had places for. We have been surprised at times at the seeming lack of loyalty to their employers by those who have been so long on Bell payrolls. Perhaps a little analysis of Bell methods may explain this situation and furnish a warning for ourselves. The rewards among the employees of the Bell heretofore have not been great either in salary or opportunities. They have been made to feel more like machines than human beings. In many cases they have not had their inventive tendencies encouraged by proper compensation for what they produced; indeed, they have been compelled to part with their inventions on the theory that their brains as well as their labor, belonged to their employer, or because there was but one market for their invention and devices. That market could set its own price upon what it bought. Such conditions are not conducive to loyalty, or to inducing energetic service. The independents, if they shall copy Bell methods in this respect, will make a grievous mistake.

If you should wake up some fine morning and hear that you have sold, or are about to sell, your telephone plant to the Bell company do not consider that the transaction is necessarily closed. If you hear similar reports as to actual or impending sales of other independent companies in your own or other States, be not disturbed thereat, nor convinced that the news is reliable. There have been some such sales, but vastly more rumors of those which never have occurred and do not seem likely to. There have been methods in these rumors. For some reason, some interest, evidently not independent, has believed it desirable to circulate such reports, probably in the hope that other independent interests might be disquieted or discouraged, and yield more readily to apparently advantageous offers. These methods have been relied upon to produce serious effects. Keep yourself and your neighbors advised of the strength and growth of the independent movement, of the strength of their own situation in competition, and fewer such rumors will be verified hereafter.

In nothing that I have said thus far have I given many of you real news. As I said to one of my friends, I felt that it was impossible to do so, and was almost ashamed for having tried to prepare and read such a paper; but if it shall refresh your memory, if it shall induce you to give other experiences and observations of your own; if it shall attract, through publication in our annual reports or otherwise, the attention of any who are about to engage in the telephone business, and shall hearten and strengthen them in their enterprise and efforts, it may accomplish some of the good earnestly desired and intended in the preparation of the paper. As stated at the outset, it is not in criticism or derogation of the Bell company that is offered. That corporation has the right to resort to any efforts within the bounds of fact, it may choose to make, and we have equal right to discuss its methods and by considering them, minimize their effect, if not entirely to overcome them.

In reply to an inquiry from Mr. Critchfield, the speaker said that only three small companies in Michigan had been inveigled from their "independent" allegiance. One had a grounded iron wire service, in parts of two counties; one was an exchange of about 25 members, and one had about 116 subscribers.

Invitation was read to visit the independent exchange of Mr. Stinson, at Rochester.

A request was read from Mr. John Rohrer, president of the Business Men's Central Council, of Buffalo, asking for information as to the cost of equipping an up-to-date exchange in that city.

It was announced that Dir.-Gen. Buchanan, of the Pan-American Exposition, would meet the members at 3 p. m. in the Electricity Building.

Messrs. Black, Ware and Kline were appointed a committee to audit the books of the association.

Mr. Fisher referred to the statement of Mr. Kline that Washington was the only Eastern city without an independent telephone franchise. As that city was under Congress, he urged every member to influence their representatives to change this.

Mr. Kline explained that but for the delay on the River and Harbor bill at the last session of Congress, Mr. Webb, who had already done such good work with his exchanges at Pittsburg and Baltimore, would have had a franchise for Washington. It wasn't votes he wanted, but the chance for voting. He alluded to the good work that had been done, and carried a rising vote of thanks to President Thomas for his able leadership.

By tremendous acclamation, a vote was carried condemning bitterly the service of the steamboat company that had transported the members to Niagara and back on Wednesday afternoon.

CRITCHFIELD ON LEGISLATION AND LITIGATION.

Mr. H. D. Critchfield, general counsel of the Cuyahoga and United States Telephone companies, of Cleveland, delivered an eloquent address on "Legislation and Litigation," in spite of the fact that he had been sick at Hot Springs, Ark., and was barely convalescent. He said that he should have opposed an open discussion of these points, as furnishing information to their adversaries. He then referred briefly to the subject of right of way, and said that, broadly stated, the legislature had no power to give them the right to put poles and lines on the highway unless subject to the limitations which are always upheld for the protection of property. If damage was done, it must be judicially determined, and it was well to be as diplomatic as possible in getting their rights of way. Each year it was getting more difficult to secure rights of way for nothing.

As to taxation, he held that valuing the property at 60 per cent, as was done, was unfair to the telephone people. It was three or four times as much as was paid by railroads, electric light companies. Action should be taken to correct and equalize this wherever necessary. As to litigation, he said, in regard to the Berliner case that its settlement was due to the work of the association and its officers. There had been an idea that the money raised was to provide good salaries for certain officials. But not one single, solitary dollar had ever been paid that way, except to an earlier treasurer, who took care to pay his own salary. The officers had done their work, had traveled at their own expense, and had brought them to the point where their cause was universally recognized as legitimate.

Mr. Critchfield then spoke of the new Bell president as one of the ablest men in the country, and said that his intention was to so change the policy of the company that connections should be made between Bell and independent companies where the independents had the best of the position. There could be only one result of this again. He did not under-estimate the strength of the Bell system, and the fight was getting hotter. The Bell people were in better shape to give them a run for their money than ever. But the independents were also in better shape to sustain attacks which would be insidious, but injurious none the less. All they had to do was to stand together. The man who sold his property instead of standing shoulder to shoulder, was unworthy of any confidence whatever, placed in him by his fellow men. Besides, the stockholders in the 4000 independent companies by their political and social affiliations ought to be able in every way to dictate the telephone situation in the United States.

He then moved the following resolution, which was unanimously carried:

BE IT RESOLVED, by the Independent Telephone Association of the United States, in Convention assembled at Buffalo, N. Y., June 11, 12 and 13, 1901, That the thanks of this Association and of all persons whomsoever interested in the welfare of the independent telephone movement of the United States, is due to the officers of this association for their faithful, intelligent and untiring efforts to promote the welfare of independent telephony; and,

BE IT FURTHER RESOLVED, That thanks are especially due to Hon. R. S. Taylor, E. P. Payson, and others enthusiastically associated for the work done in the litigation recently decided by Judge Brown in the United States District Court for the Northern District of Massachusetts, involving the validity of the so-called Berliner patent, and that the successful conduct of this litigation is fully appreciated by this Convention.

BE IT FURTHER RESOLVED, That the secretary be and is hereby instructed to prepare and forward to the persons herein named copies of this resolution.

Mr. C. T. Bash, Home Telephone Company, of Fort Wayne, Ind., in commenting on Mr. Critchfield's address, said that they now had 2146 independent subscribers there, although for 2½ years past every quarter the Bell company had been sending receipted bills to the 500 subscribers, or less, on their system, who paid not a cent. As to needed legislation, he instanced a case in Fort Wayne recently, where when the Wayne Hotel was on fire, the telephone line in an adjoining building was found to have been cut and thus warning could not be sent promptly through the exchange. There should be legislation to protect their circuits just as much as there was to in-

sure the railroads against malice, etc. Mr. Bash then poked fun at the Central Union, but the laugh was turned on him when he spoke of Mr. Sabin being at the head of the Philistines who were submerged in the Red Sea.

Invitations to hold the next meeting at Milwaukee, Philadelphia, Rochester, Mansfield, Ohio; Louisville, etc., were referred to the advisory board.

A committee of three, being appointed by Mr. Young, in the chair, to select a ticket for the ensuing year, the following ticket was reported and adopted very enthusiastically: President, J. M. Thomas, of Chillicothe, Ohio; first vice-president, H. C. Young, of Columbia, Pa.; second vice-president, C. E. Stinson, Rochester, N. Y.; third vice-president, W. H. Durin, of Cedar Rapids, Iowa; secretary and treasurer S. P. Sheerin, of Indianapolis; first assistant secretary, J. B. Ware, of Detroit; second assistant secretary, C. E. Wilson, Philadelphia; third assistant secretary, J. B. Lee, of Pittsburg, Pa.

Thanks were tendered to *Telephony* for organizing a special train from Chicago, and to the Buffalo press, especially the *Courier,* for its efforts in behalf of independent telephony.

Mr. Dougherty advocated the compilation of a complete list of independent telephone companies. No action was taken.

Mayor Diehl was thanked for the free use of the city Convention Hall.

The auditing committee reported finding the accounts of the association in satisfactory shape.

The Convention then adjourned.

LIST OF ATTENDANTS.

The following are the names of the delegates and members. The names of those representing manufacturers, supply houses, press, etc., will be found elsewhere:

Western Penn. Telephone Company.—J. B. Painter, Independence, Pa.

Cortland (N. Y.) Home Telephone Company.—H. L. Smith, W. Martin, W. H. Jones.

Morrow Co. Telephone Company, Mt. Gilead, Ohio.—A. A. Whitney.

Cuyahoga Telephone Company, Cleveland, Ohio.—J. J. Fitzgerald, M. Davis, L. W. Stanton.

U. S. Telephone Company, Cleveland, Ohio.—T. Gilmore, W. L. Cary, Jr., K. V. Murry, C. J. Ross, H. D. Critchfield, J. M. Thomas.

Federal Telephone Company, Cleveland.—J. Pierce, W. B. Woodbury, R. R. Fralich, N. Coen, M. E. Zuber, O. Miller, O. F. French, H. K. Taylor, R. W. Judd, G. S. Duperow, R. C. Enwright.

Eastern Telephone & Telegraph Company, Camden, N. J.—G. W. Burleigh.

Wellsburg (W. Va.) Telephone Company.—W. K. Cummings.

Juniata & Susquehanna Telephone Company.—A. G. Scholl.

Interstate Telephone & Telegraph Company.—J. P. Helfenstein.

Tuscarawas County Telephone Company, Cleveland.—G. J. Hoffman.

Ottawa County Telephone Company, Oak Harbor, Ohio.—F. W. Gradolph.

Morrison Telephone Company, Greenfield, Ind.—G. Morrison.

Ontario Telephone Company, Toronto, Can.—J. B. Ford.

Queen City Telephone Company, Buffalo, N. Y.—H. H. Littell.

Louisville (Ky.) Home Telephone Company.—W. G. Patten.

U. S. Telephone Company, Dunkirk, Ohio.—E. S. Anderson.

Bremen Telephone Company, Bremen, Ind.—C. E. Koontz.

Johnson Co. Telephone Company, Iowa City, Ia.—J. D. Goss, A. T. Presson.

Mansfield (Ohio) Telephone Company.—T. F. Black, L. C. Mengab.

Cedar Rapids (Ia.) Telephone Company.—W. H. Durin.

Columbia (Pa.) Telephone Company.—H. C. Young.

Portsmouth (Ohio) Telephone Company.—T. W. Human, H. S. Gowe.

Bowling Green (Ohio) Telephone Company.—W. R. Barkdull.

York (Pa.) Telephone Company.—G. W. Rudy, W. Hughes.

National Telephone & Telegraph Company, Fort Wayne, Ind.—G. F. Trier, G. W. Beers.

Zanesville (Ohio) Telephone & Telegraph Company.—J. B. Rhodes, S. M. Branger.

Inland Telephone Company, New Knoxville, Ohio.—W. H. Fledderjohn.

Inland Telephone Company, De Graff, Ohio.—E. Fledderjohn.

People's Telephone Company, Akron, Ohio.—S. M. Strong.

Galion Telephone Company, Galion, Ohio.—J. T. Belanger, B. W. Blyth, C. T. Crim.

Cattaraugus Telephone Company, Franklinsville, N. Y.—V. Haydon.

Interstate Telephone Company, Philadelphia.—A. M. Worstall.

Burlington Co. Telephone Company, Mt. Holly, N. J.—H. E. Woodman.

Twin City Telephone Company, Minneapolis, Minn.—C. H. Judson.

Citizen's Telephone Company, Ashland, Ky.—W. B. Seaton.

Federal Telephone Company, Pittsburg, Pa.—Fred De Land.

Sandusky (Ohio) Telephone Company.—C. C. Curtis.

Columbian County Telephone Company, Lisbon, Ohio.—W. Morron.

Southern Telephone Company, Nashville, Tenn.—F. F. Sapp.

Kent Home Telephone Company, Kent, Ohio.—W. H. Butler, A. B. McLery.

People's Telephone Company, Shelby, Ohio.—C. L. Howk.

Marysville (Ohio) Telephone Company.—N. E. Liggett, G. T. Suvern.

Upper Sandusky (Ohio) Telephone Company.—C. D. Juvenall.

Madison Clark Telephone Company, London, Ohio.—F. W. Pierce.

Rochester (N. Y.) Telephone Company.—C. O. Harris, W. F. Babcock, C. E. Stinson.

Valley Telephone Company, Bay City, Mich.—H. A. Price, B. L. Carson.

Anderson (Ind.) Telephone Company.—C. D. McConehay.

Lafayette Telephone Company, Lafayette, Ind.—H. A. Taylor.

Youngstown Telephone Company, Youngstown, Ohio.—S. Weil, C. Y. McVey.

Tippecanoe Telephone Company, Romney, Ind.—Dr. A. D. Pyke.

Massillon (Ohio) Telephone Company.—W. S. Holloway.

Ottawa Co. Telephone Company, Elmore, Ohio.—J. G. Steinkemp.

Knoxville (Ia.) Electric Company.—J. S. Bellamy.

Home Telephone Company, Wabash, Ind.—J. Hipskind, R. F. Blount.

Fair Telephone Company, Chrisman, Ill.—G. W. Fair.

Louisiana & Texas Long-Distance Telephone Company, Thibadaux, La.—T. H. Lancaster.

Elk Telephone & Telegraph Company, St. Marys, Pa.—A. H. Blasdell.

Jefferson & Warren Telephone Company, Orangeville, Ohio.—E. U. Hyde, C. S. Fenton.

Putnam Telephone Company, Ottawa, Ohio.—J. F. Risser.

Black River Telephone Company, Lorain, Ohio.—C. D. Gott.

Ada Telephone Exchange Company, Ada, Ohio.—H. A. Clark.

Harrison County Telephone Company, Cadiz, Ohio.—A. J. Vernier.

Connersville (Ind.) Telephone Company.—L. A. Frazee.

Home Telephone Company, Fort Wayne, Ind.—C. S. Bash.

Citizens' Telephone Company, Grand Rapids, Mich.—E. B. Fisher.

New Long-Distance Telephone Company, Indianapolis, Ind.—S. P. Sheerin.

Keystone Telephone Company, Philadelphia, Pa.—C. E. Wilson.

Interstate Telephone & Telegraph Company, Hazelton, Pa.—C. W. Kline.

People's Telephone Company, Detroit, Mich.—J. B. Ware.

Ashtabula (Ohio) Telephone Company.—T. J. Fricker.

Lima (Ohio) Telephone & Telegraph Company.—G. H. Metheany.

Hubbard City (Tex.) Telephone Company.—H. McFarlan.

Telephone Company of America, Washington, D. C.—R. B. Hazlett.

REGISTERED, but not giving other indications of connection with the industry, were: J. B. Lee, Pittsburg; C. L. Fisher, Findlay; J. S. C. Edwards, Johnstown, N. Y.; E. C. Taylor, J. C. Firmin and J. D. Snyder, all of Findlay, Ohio; T. M. Knierin, Toledo, Ohio; E. Hendrickson, Macedene, N. Y.; H. A. Coit, St. Louis, Mo.; W. F. Adely, Boston, Mass.; I. H. Moulton, La Cross, Wis.; H. W. Fox, Indianapolis; A. A. Geiger and R. Mitchell, Bluffton, Ohio; E. L. House and C. M. Grauel, Painesville, Ohio; Claude R. Stoops, Nappanee, Ind.; H. E. Inks, Ligonier, Ind.; R. B. Watrous, Milwaukee; A. L. Lawrence, Cleveland; A. M. Taylor, Cleveland.

CONVENTION NOTES.

PAN AMERICAN.—A visit of the delegates was paid to the Pan-American Exposition on Thursday afternoon, when they were received in Electricity Building by Director-General Buchanan and Professor G. F. Sever, superintendent of electrical exhibits. A cordial official welcome was extended to them, and they spent some time in examining the telephone exhibits, especially the superb displays of the Kellogg, Stromberg-Carlson and American Electric Telephone companies—not even forgetting the working Bell exhibit, and those of the makers of conduit and cable. Many calls were paid to the booth of the ELECTRICAL WORLD AND ENGINEER, which adjoins the telephone section. Of course, in the evening all were delighted with the electrical display created by the genius of Mr. Luther Stieringer, who in reality has furnished a second Pan-American, viz., that for the night, an even more lovely one than that of the daylight and sunshine. In reality, it is only at night that the Howard Tower realizes itself and dominates the scene. Many of the telephone visitors were greatly interested in the signal corps display in the Government Building, and in the operative exhibit there, in the Patent Office section, of the Palmer fac-simile long distance telegraph.

ELECTRICAL WORLD AND ENGINEER had its headquarters at the Exposition, and was represented at the Convention by Messrs. T. C. Martin and J. R. Cravath, of the editorial staff, and President J. M. Wakeman, J. V. S. Church and E. T. Walker, of the business department.

THE ELECTRICAL PRESS, in addition to the staff of this journal, was represented by W. F. Collins, C. T. Child, W. E. Keily, M. H. Murch, Jr., N. Hall, G. A. Babtiste, R. Howland, P. E. Rotchka, F. L. Perry, E. Taylor, S. H. Goddard, H. B. McNeal, W. J. Barr, W. H. Goontz and others not registered.

MR. A. V. ABBOTT, the well-known electrical engineer, who was until lately with the Chicago Telephone Company, was an interested attendant at the convention. Since giving up his Bell connection, Mr. Abbott has already been engaged in connection with several electrical enterprises, some of which deal with power transmission and electric railway work.

MR. F. C. MANNING, secretary of the Sumter Telephone Manufacturing Company, tells an interesting story of how his company resurrected the telephone service in Jacksonville, Fla., after the disastrous fire last May. The fire extended over an area of three miles long by one mile wide in the heart of the city, thus demoralizing the entire service. It occurred on Friday, May 3. The following day Mr. Manning received a telegram from Mr. W. N. Shine, general manager of the Jacksonville Telephone Company, asking him to ship a switchboard immediately. So promptly did the Sumter Telephone Manufacturing Company respond that on Tuesday 100 telephones were in operation, and in less than two weeks all the telephones which had not been burned up were in use through switchboards located in different sections of the city and connected up by trunks. The first switchboard was erected in a little booth used as a fruit-stand, and the 100 telephones were connected up by cutting a hundred-wire cable in front of the booth and distributing it in the switchboard. Who shall say the South is not exemplifying the "strenuous life" after such a performance as this? The Jacksonville Telephone Company is now re-equipping its entire system, and will shortly be giving even better service than it did before the fire.

MR. W. J. JOHNSTON, the veteran electrical publisher and now proprietor of *Mining and Metallurgy*, dropped in from the Pan-American Exposition and was greeted by a great many old friends.

EXHIBIT NOTES.

MR. OTTO M. KNOBLOCK attended in behalf of the important interests of the Miller-Knoblock Manufacturing Company, of South Bend, Ind.

MR. S. J. LUMBRIDGE represented the Utica Fire Alarm Company, of Utica, N. Y.

THE UNION SWITCHBOARD COMPANY, of Erie, Pa., who has a very ingenious and effective board on a novel plan, was represented by Mr. John J. Miller.

ERNER, HOPKINS COMPANY, of Columbus, Ohio, was represented by Mr. W. A. Hopkins.

THE AMERICAN ELECTRIC TELEPHONE COMPANY.—Located in the most accessible position of Electricity Building is the beautiful pavilion of the American Electric Telephone Company, Chicago. The exhibit is at the northeast corner of the building. The design is Colonial, with Corinthian columns. In it is displayed a complete collection of the American Electric Company's telephone devices and apparatus. Among the large number shown may be mentioned their standard power board, furnished with its central energy system. On the board are mounted ammeters, voltmeters and necessary switches and cut-outs. Adjoining the power board is seen a 1.5-kw "Roth" dynamotor transforming from 500 volts 3 amperes to 60 volts and 25 amperes. A current interrupter is also shown, giving a pulsating current of 500 volts at 900 revolutions. Then there is a 100-line Bell type switchboard, a 300-line metallic cross-connecting board, a hundred-line "American Express," finished in a most elaborate manner. Five 100-line Burns combined heat coil lightning arrester, and terminal heads, are placed in the center of the wall and attract much attention from telephone engineers and managers. In a handsome show case facing the main aisle is displayed a complete line of the smaller parts and accessories entering into the construction or operation of telephones or switchboards, comprising a desk set. A number of the new American receivers show the great advance made in this necessary adjunct. Multiple apparatus is displayed in sections, showing the mechanical construction and design for magneto call, common battery and central energy systems. Favorable comment was made by the delegates on the American "Samson" 5-bar generator with new self-contained switchhook. A line of individual lightning arresters and cable protectors are extensively displayed, including everything latest and best in this line. The line of listening and ringing keys is shown in several styles and designs. Three different patterns in desk sets are shown in elaborate finish and beautiful design. Favorably displayed on the wall is one of the handsomest lines of magneto call centralized calling and central battery telephones ever produced. The types and designs comprise 26 separate and distinct patterns. The new No. 34 central energy telephone received more than passing attention on account of its beautiful design and finish. Aside from the technical features of the exhibit the chaste and elegant design and execution of the pavilion was the subject of much deserved praise and admiration. This artistic place was done under the supervision of Mr. S. J. Bear, general Western agent, who also designed and executed the American exhibit at Omaha. Mr. Bear is in charge of the exhibit extending to all callers a cordial invitation for its inspection. The staff of this well-known company, in addition to President P. C. Burns and General Manager J. G. Johnson, consisted of P. J. Eubanks, Ohio representative; J. J Speed, of the home office; C. E. Kammeyer, advertising department, and the necessary clerical force. Owing to the very large increase in orders at the factories the erection of the large central energy multiple switchboard has been delayed and could not be completed in time for the inspection of the visiting delegates.

NATIONAL INDIA RUBBER COMPANY, Bristol, R. I., was represented by Mr. P. F. Lyons.

THE DURHAM TELEPHONE MANUFACTURING COMPANY, of Durham, N. C., was represented by its general manager, C. E. Egan, formerly general manager of the Interstate Telephone & Telegraph Company, operating in Maryland, Virginia and North Carolina. He was kept busy explaining a new pay station telephone device his company is just putting out. This differs from most pay station or prepayment devices in that the coin can be given back to the calling subscriber in case the desired connection is not secured. In an ordinary prepayment telephone there is often an annoying delay while the calling subscriber puts in his coin before the central office completes connection. With the Egan device this delay is done away with by having the calling subscriber drop the coin in the slot before the central office can be called. Normally, the generator circuit is open, and no calling can be done without putting in the coin, which closes the circuit. If the connection is completed and conversation secured the hanging up of the receiver knocks the coin down into the strong box. If, however, the connection is not given, the central office so informs the caller and closes a circuit so that when the subscriber presses a button to complete another part of the circuit the coin is thrown out into the open receiver in front of the telephone. Now that prepayment systems and other methods calculated to do more justice to both stockholders and public are coming in, Mr. Egan's device is of particular interest.

THE MAYBERRY-HOLMES PARTY-LINE SYSTEM is a recent arrival in the telephone field, and was exhibited in Parlor 72 at the Iroquois. This system allows the putting of as many subscribers on the line as may seem desirable. Calling central on one instrument locks the hooks on all the other instruments on the line, and displays a busy sign. When a subscriber on a party line of this kind is called none of the other bells ring, and all other instruments on that line are locked out, and have busy signals displayed. The system can be

GROUP OF INDEPENDENT TELEPHONE CONVENTION, BUFFALO, N. Y., JUNE 12, 1901, OUTSIDE CITY CONVENTION HALL.
(OFFICERS ON BENCH IN FOREGROUND.)

applied to any standard telephone. It is the property of Dr. F. E. Mayberry and Watson M. Holmes, of West Medford, Mass., both of whom were at the convention.

THE COUCH & SEELY COMPANY, 26 Binford Street, Boston, Mass., had a very complete line of its representative products in Parlor 72 at the Iroquois. E. B. Seely and A. F. Boardman were in attendance. The latter gentleman was one of the respondents in the famous Berliner case. Among the things attracting special attention in the display was a listening and ringing key, unusually perfect as to details, with which the operator can listen, ring and ring back, using the same key and with a very simple movement. Two styles of intercommunicating call-box were shown. One of these was a key-box in which the contact is established and ringing done by the same key and only one key will stay depressed at a time, making confusion of calls impossible. The other was a plug box. The neat outdoor outfit used extensively on electric railway interurban lines and for a police patrol box attracted considerable attention. In this instrument the shutting of the door cuts out the instrument so that it is only in circuit when the door is open. The common battery wall instrument for ordinary subscribers' use is a very compact and neat little instrument designed expressly for common battery service. The hotel set made by this company which is used in the Essex Hotel at Boston was shown alongside the regular set used in the Iroquois Hotel, and the contrast was striking, as the Couch & Seely set was only about a quarter the size of the other.

ROTH BROTHERS & CO., of Chicago, who are doing such an extensive business these days in small motor-generator sets for telephone exchanges had G. A. Roth, of the firm, looking after their interests. This firm came up from a small beginning a few years ago, but is making friends everywhere by its square dealing and the satisfaction its machines are giving, so that its history has been one of constant growth. A motor-generator set of Roth make was on exhibition in the American Electric Telephone Company's booth at the Pan-American Exposition.

GENERAL ELECTRIC COMPANY does not usually manifest much interest in a telephone convention, but since the miniature lamp signal has become such an important factor in switchboard construction the lamp department is beginning to respond actively to the demand, and F. W. Willcox, of the Edison Miniature Lamp Department, Harrison, N. J., was present, learning the needs of the telephone men, and showing his company's miniature lamp product. He carried a complete exhibit in his vest pocket. Mr. Willcox was on several occasions the center of an animated discussion of the features of lamp-signal work.

THE AUTOMATIC TELEPHONE METER COMPANY, of 620 Atlantic Avenue, Boston, Mass., had a working exhibit of its new automatic meter system in Parlor 72, at the Iroquois Hotel. A small switchboard and two subscribers' instruments connected thereto with automatic meters at each subscriber's instrument, showed the working of the meter. This meter is a counter which registers only when the called subscriber removes his telephone from the hook to answer. The operator has nothing to do with registering the calls, nor is any time lost by the process, the operation as far as operator and subscriber are concerned being the same as if no meter were on the circuit. Mr. Charles H. Viggars explained the system to visitors at the parlor.

THE ELECTRICAL APPLIANCE COMPANY kept open house at Parlor 222 of the Iroquois Hotel, where some of the telephone specialties of the company were shown. A. L. Millard and S. A. Densmore represented the company.

THE CLARK AUTOMATIC TELEPHONE SWITCHBOARD COMPANY, of Providence, R. I., received many visitors at its handsome space in Electricity Building at the Pan-American Exposition during convention. J. L. Putnam, chief electrical engineer of the company, came on from Providence to attend the convention, and L. A. Stillings and F. Ingrham were also present. The Clark is an automatic switchboard system, which does not require any central office operator, and it is adapted to factory and small town exchanges up to 150 subscribers' stations.

THE AMERICAN BATTERY COMPANY, of Chicago, which does an extensive storage battery business among telephone companies, had its interests ably looked after by its secretary, C. S. Kaufmann.

F. BISSELL & CO., of Toledo, Ohio, had the following gentlemen in attendance: W. S. Bissell, M. S. Walker and C. H. Hamilton.

THE CENTRAL ELECTRIC COMPANY, of Chicago, had Allen S. Pearl looking after its interests.

THE AMERICAN ELECTRICAL WORKS, Providence, R. I., was represented by W. J. Watson, of New York, and E. H. Hammond, of Chicago.

THE AMERICAN MINIATURE & DECORATIVE LAMP COMPANY, of New York, recognized its growing importance in the telephone field by sending H. J. Jaeger as its representative.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY was, of course, out in force, having a representation in proportion to its size and volume of business. A. Stromberg, C. W. Stiger, H. Shafer, E. L. Brown, William Davis, Paul M. Krahmer, P. J. Hertz and S. Curtis were on hand to look after the company's interests both at the convention and at the company's large space in Electricity Building at the Pan-American Exposition. Unfortunately, they were delayed about getting the material for the principal part of the Exposition exhibit which will be very large and comprehensive, and will include a large switchboard installation. Their space, however, appeared to good advantage, and with the choice selections from their stock of apparatus which were on exhibition, in lieu of the more permanent exhibit that is to come later, a handsome showing was made. This company operates a free telephone service on the Exposition grounds for the benefit of the officers and service bureaus of the Exposition. The central office is located in the company's space. The service is of great utility, and is highly appreciated.

W. J. MURDOCK & CO., of Chelsea, Mass., represented by Mr. Murdock himself, distributed a souvenir button and receiver, advertising the "solid" receiver, almost large enough for regular service.

THE AMERICAN ELECTRIC FUSE COMPANY, of Chicago, was well represented by President Jones, "who pays the freight"; James A. Kenny and Price A. Allison. They were generously profuse in courtesies to the delegates.

THE COLUMBIA TELEPHONE MANUFACTURING COMPANY, 194 South Clinton Street, Chicago, made its debut at this convention. Although a new company, its representative, J. G. Nolan, who is the leading spirit and inventor of the specialties that were exhibited at the Iroquois parlors, is one of the oldest and best known men in the independent telephone business. The leading feature of the display was a switchboard which had the subscribers' circuits terminating on a plug and tip, and having jacks on the ends of cords, thereby reversing the usual arrangement and making what Mr. Nolan calls an "anti-dust" switchboard.

THE WILLIAMS ELECTRIC COMPANY, of Cleveland, Ohio, represented by J. A. Williams, president and general manager, and J. A. Stratton, displayed some of that company's more notable products in one of the parlors of the hotel.

THE HIPWELL MANUFACTURING COMPANY, 831 North Avenue, Allegheny, Pa., exhibited its line of high grade long-distance telephones in the parlors of the hotel. H. H. Hipwell and T. Hipwell did the honors.

THE LAMBERT SCHMIDT TELEPHONE MANUFACTURING COMPANY, 325 Broadway, New York, occupied Parlor 80 at the Iroquois Hotel, with a very neat and complete exhibit which attracted much favorable comment. The appliance that was most noticed was a new portable switchboard for army use and other places, or purposes requiring a portable switchboard or very rapid connections. A 6-drop and a 10-drop board of this kind was shown. Instead of cords and plugs connections are made by means of cam keys similar to ringing keys. There are three rows of cams on the 10-drop board, and each line has a terminal on three cams. If No. 1 and No. 2, for example, should wish to talk, the cams 1 and 2 in the first row would be thrown. The cams on the next row would be used should other parties wish communication, and so on until all are occupied. A small semi-portable board using plugs and jacks was also shown, this not possessing, however, the rapidity of operation and portability of the cam board. The intercommunicating instruments of this company are also exceptionally neat. They are made in several types, and are fitted all with automatic flyback switch, which returns to "off" when the receiver is hung up. These were shown in both wall and desk forms. The switch is operated with a thumbscrew and provided with numbers, as on a cyclometer barrel. Only the thumbscrew is outside of the case. All these designs are provided with head microtelephone of very strong, handsome design, or regular transmitter and receiver. One decidedly new kind of telephone designed expressly for the convention was in operation in the parlors. Attempts to call on this telephone were responded to by the flying open of the battery box, when it was found that the battery was charged with cigars. Lambert Schmidt, president; W. W. Bostwick, Jr., and Mr. Schwartz were in attendance.

The Electric Storage Battery Company, of Philadelphia, had its interests looked after by Otto C. Cathoff.

The Eureka Telephone Company, of Chicago, was represented by that well-known telephone man, I. J. Kusel.

The Varley Duplex Magnet Company had C. L. Hibbard, of Chicago, in attendance.

The Valentine-Clark Company, of Chicago, was represented by E. L. Clark.

The Holtzer Cabot Electric Company, Brooklyn, Mass., showed some of its specialties in Parlor 222, of the Iroquois Hotel. The stick fast butterfly souvenir the Holtzer-Cabot people threw around was much in evidence not only at the convention and hotels, but at the Pan-American, and especially on the midway. C. W. Holtzer, T. W. Ness and W. H. Holland, of Brookline, and E. R. Harding, of Chicago, were there.

The International Specialty Company was represented by G. Hallett Johnson, of Chicago.

The India Rubber & Gutta Percha Insulating Company had for representative Dr. W. M. Habirshaw, who met many old and new friends.

The Laclede Battery Company, of Kokomo, Ind., was represented by J. F. Kerbin.

The McRoy Clay Works, Brazil, Ind., had "the genial and convivial Kirk" on hand everywhere at the convention, although in nowise associated with exercises of the conventicle.

The National Conduit & Cable Company sent J. B. Honan to represent it.

The Monarch Fire Appliance Company, of New York, had C. H. Barney and H. J. Doyle at the convention, and these gentlemen were naturally much gratified that "Kilfyre" tubes have just been adopted for the protection of all the switchboards at the Pan-American Exposition. General Barney was one of the oldest telephone men present, and with other old-timers, recalled memories of the Bell Niagara meeting 20 years ago.

The North Electric Company, of Cleveland, gave away souvenir good-luck pieces through Mr. S. S. Sapp, its energetic representative. George W. Conover, Chicago agent, was also present. The convention hall was also strikingly decorated with some of their literature.

The National Automatic Telephone Company, of 153 West Jackson Boulevard, Chicago, entertained in its regular space in Electricity Building at the Pan-American. J. A. Russell came to look after the company's interests and explain to interested delegates the working of the National automatic system, which is in use in a surprisingly large number of exchanges.

J. Edward Ogden & Co. were represented by Paul H. Schapfer, of New York.

The Okonite Company had its interests looked after by George T. Manson, of New York.

The Phoenix Electric Telephone Company was represented by D. P. Scott.

John A. Roebling's Sons Company, Trenton, N. J., sent W. G. Quigley, of the home office; W. N. Slughiff, of Chicago, and W. T. Bowman, of Cleveland. Mr. G. W. Swann, their Exposition representative, was also very much in evidence, and distributed pliers.

Mr. Charles A. Rolfe, of the Rolfe Electric Company, of Chicago, was present.

The Sterling Electric Company had W. E. Doolittle and F. B. Cook in attendance, and could not have been more thoroughly represented had there been many more, so well are these faces known in the independent field. They report the factory crowded with orders.

The Standard Underground Cable Company turned out a large force from various quarters, as usual, consisting of T. E. Hughes, of Philadelphia; J. R. Wiley, of Chicago; C. L. Wiley, of New York, and A. V. Sauerman, of Boston.

Charles G. Stevens, dealer in electrical specialties at Chicago, was present.

The Williams-Abbott Company, of Cleveland, of which H. C. Dodge is general manager, was looked after by Mr. Dodge and L. Sands.

The American Vitrified Conduit Company was represented by Mr. Barnard.

The Chase Shawmut Company, of Boston, was represented by H. P. Moore, who gave away samples of the Boston cable clip.

The S. B. Condit, Jr., & Co., of Boston, is introducing the Cameron system of cable-placing machines and hangers, and Mr. Condit was talking up this system among the telephone construction men present and calling attention to the saving of time by this process.

The Eureka Electric Company, of Buffalo, had George B. Pratt in attendance.

The Kellogg Switchboard & Supply Company was out in force and much in evidence, both downtown at the Convention, where its numerous representatives were seen, and at the Electricity Building at the Pan-American. At the latter place, a magnificent booth, the work of weeks, was just completed in time for convention visitors, and there some excellent samples of the company's switchboard work on a large scale were found. In an annex to the booth in another part of the building, subscribers' instruments were shown. Mr. Milo G. Kellogg, the company's leading spirit, was, of course, in attendance, and among his corps of assistants at the Convention and Exposition were F. J. Dommerque, Charles L. Meyers, Paul Bossitt, Mr. Platt, of New York, and A. E. Barker, of Cleveland. A handsome card case was given as a souvenir to telephone men visiting the booth Thursday afternoon.

Wagner Electric Company, of Muncie, Ind., were represented by Mr. McDonald.

G. F. Atkinson Company, of Jersey City, N. J., was represented by H. F. Atkinson.

Central Construction Company, Wauseon, Ohio, were represented by E. L. Barber.

Phoenix Telephone Company were well represented by Mr. J. H. Scofield.

American Toll Telephone Company, of Cleveland, represented by Messrs. W. A. Foss and E. F. Kaneen, distributed a very pretty and effective pamphlet as to their ingenious automatic pay station apparatus. The various types of machines for different services and rates, etc., were illustrated, and the *modus operandi* explained, the details being given as to the single, two and three-slot boxes. The wall set and the cabinet type were also illustrated and described in a full and clear manner. Other apparatus brought to notice in the pamphlet were the call register to record outgoing calls, the instruction card holder and the cigar rest.

T. W. Warner, of Muncie, Ind., well known in the telephone field as the maker of the Warner central office pole changer ringing outfits for use with both dry and wet batteries, was at the Independent Telephone Convention, and had an exhibit in the booth of the American Electric Telephone Company at the Pan-American Exposition. In his latest form of ringer for central offices a small make-and-break pole changer is operated constantly by a type R R cell of Edison-Lalande battery. This pole changer changes from direct to alternating the current supplied by a battery of 40 to 60 cells of open circuit type, and this alternating current does the ringing. The pole changer is of good workmanship, and is mounted in a glass case on top of the cabinet containing the batteries. This neat little outfit comprises a complete power plant for ringing purposes in the telephone exchange. As the capacity of a battery cell is so large in amperage there is no difficulty in regard to sufficient current supply. This ringing apparatus is now in use in over 1200 exchanges in the United States, and though originally designed and sold to independent exchanges only, its excellence for its purpose has led Bell exchanges to purchase a large number of them. Ordinarily 40 cells of common dry battery are sufficient, but room for 60 is provided. If other than dry batteries are used the generator alone is provided and the batteries are placed in another room.

Mr. Vinton A. Sears represented the Eastern Automatic Telephone Company. Besides being vice-president of this company, which controls Eastern territory for the Strowger system, he is a director in the automatic telephone companies of both New Bedford and Fall River, Mass.